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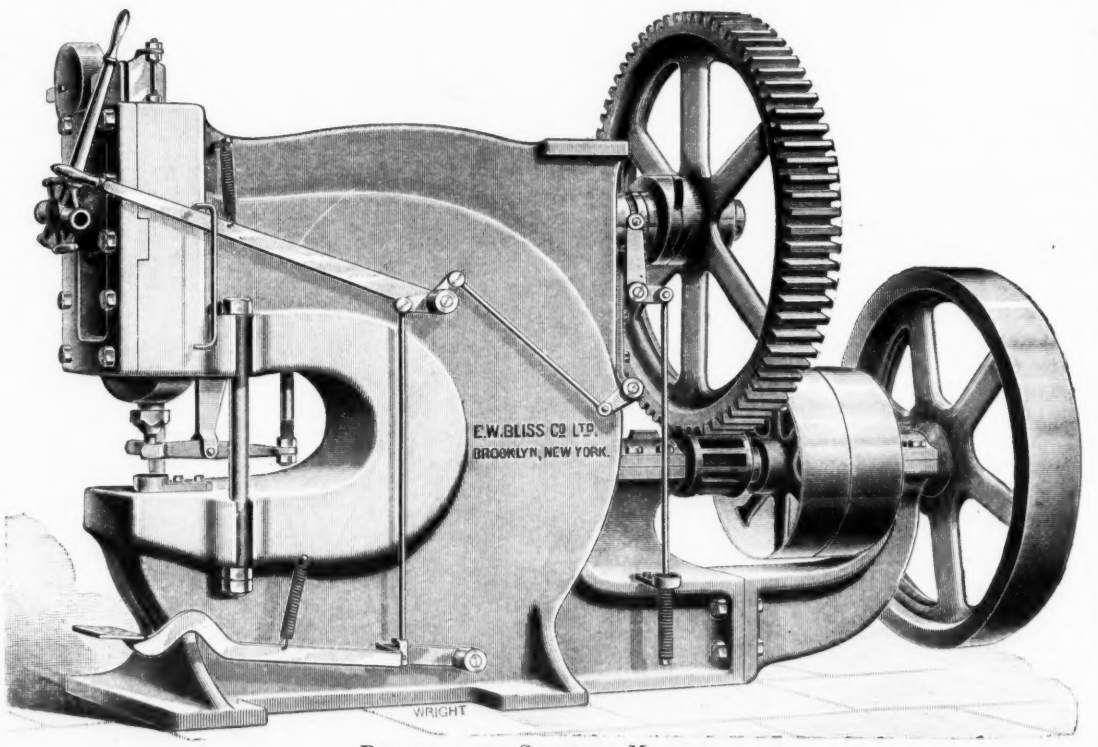
Punching and Shearing Machine.

On this page we give an illustration of a punching and shearing machine which is representative of a new line of such machinery recently brought out by the E. W. Bliss Company, of Brooklyn, N. Y. The engraving shows that the machine is designed with a view to meeting the requirements of the latest practice in respect to strength, rigidity and power.

The clutch can be operated either by hand or foot, and either the hand-lever for this purpose, or the foot-treadle, can be operated without moving the other, and on the larger sizes of machines the clutch is disengaged by a positive device instead of by a spring. They are also furnished, when required, with an automatic clutch, *i. e.*, a clutch which, when engaged by the movement of either lever, is automatically disengaged at the end of the stroke, thus giving the operator any desired time for the arrangement of the work where the time between two strokes of a machine working continuously is not sufficient.

The strippers are easily adjusted for any desired thickness, and in adjusting either the work or punches and shears, the slide can be brought down by the capstan wheel shown. The adjustment for wear of the slide is made by taper gibs which extend the full length, and are moved by screws at the top. Of course any kind of shears for slitting or cross-cutting, or gang punches, can be substituted for the punch and die shown.

The machines are made in all sizes calculated to punch from a $\frac{3}{8}$" hole through $\frac{3}{8}$" iron to $2\frac{1}{4}$" hole through $2\frac{1}{4}$" iron, and to shear bars up to $1\frac{1}{4}$"x10". The depth of throat varies from 6" to 48", and the weight from 1,200 pounds to 70,000 pounds.



PUNCHING AND SHEARING MACHINE.

For the Tool Builders.

A well-known manufacturer of wood-working machinery was conducting the writer through his shop recently, and among other interesting points was showing him some improvements made upon machine tools which had been purchased in most cases from well-known builders.

He thought that machine tool builders were not always as careful as they should be to make tools convenient, and to so arrange them that they could be worked to their full capacity.

"Now," said he, "look at that cutting-off machine. When I bought it, some years ago, it was the best one I could find, but it would cut off and center stock at one end of the spindle only. I added to the other end a cross-slide and centering attachment, so that when one end of the stock is cut off and centered, instead of its being necessary to take the stock out of the machine, reverse it, and put it in again, it is only necessary to shove it through the spindle to the proper point and operate upon the other end the same as upon the first, and no reversing is needed. Then there is that shaft-straightening machine. When it came here two men could barely turn the hand-wheel at the top by which the rollers are brought into contact with the revolving shaft. By bolting that bracket onto the side of the frame, and putting in gears proportioned 3 to 1, one man easily does the work. For moving the carriage there was a crank so near the floor that a man must nearly break his back in stooping to work it. A crank placed higher, with sprocket wheels and a chain to carry the motion down, made this feature very much better. Then again there is a milling machine for milling key-ways in shafting. It is built by a well-known maker, yet the head which carries the cutter arbor, and is quite heavy, was not counter weighted, with the result that when the cutter was fed down onto the shaft there was a good deal of jumping about, with disastrous results to the cutter, it being impossible to keep the gibs set up sufficiently tight to prevent the head dropping on the vertical slides and taking up the lost motion of the nut and screw in the wrong direction. A counter-weight remedied all this and makes the machine work much better. Again, there was on top of the vertical screw for moving this head merely a capstan head into which a bar had to be inserted to raise or lower the head, and only part of a revolution could be made without changing the bar from one hole to another, because of the belts being in the way. Two sprocket wheels, with a chain to connect them, one of these being in such a position that it can easily be turned, made the machine very much more convenient to handle. Again, there is that shafting lathe. The tank on it is so small that the water it holds soon becomes hot when the lathe is really working, and it was necessary for me to add another tank with twice the capacity. Now I do not, of course, pretend to know very much about tools, wood-working machinery being in my line, and it seems to me that the tool builders should not send out tools which can be so easily improved by a wood-working machinery builder. If I should send out my machinery to wood-workers so incomplete and so unhandy as many machine tools, I should certainly hear from it."

It is worth a good deal to wise people to be able to see themselves as others see them, and next to that, for a tool builder, is to be able to see his tools as others see them. We think it must be conceded that there are some points in the above which are worthy of attention, and when these are attended to there may be some others that will present themselves. Of one thing we are pretty sure, and that is that there should be more counterbalancing of heavy parts of machine tools having vertical movements, whether by hand or power.

Sometimes railroad companies find it unprofitable business speculating in land. The Lehigh Valley road purchased a considerable tract in Jersey City—more than was needed for the right of way—which was roundly assessed for the purpose of taxation. Now the railroad company is moving for an abatement.

The Mechanical Sphere.

BY A. D. PENTZ.

One object in the Japanese collection at the Metropolitan Museum, New York City, is a sphere of rock crystal about six inches in diameter. This is the most artistic thing in the collection to me, because in the production of such a sphere we rise beyond imitative art, or the art of resemblance, to actual art, or to the arts which produce results that can be demonstrated.

This beautiful Japanese globe has nothing about it to show that it was not made in New York or London, or Paris, Rome, Berlin, Vienna or Amsterdam. It is doubtful if it could have been produced in Russia, Persia or Spain, and it is certain that neither Turkey, Egypt nor Morocco could have made it so perfectly. It seems to be a true sphere, but if it be not true there are a thousand men in New York who can detect its slight errors. If it were a drawing of a sphere its truth would be a question of judgment; one man would be satisfied that it was a perfect delineation of a ball, while another would deny that it was at all satisfactory; an engineer, however, would know that the eye is satisfied with a sphere if it be imperfect to five per cent.

I asserted that there are a thousand men in New York City who could inspect the Japanese globe and prove whether it is a sphere or not. There are, in addition to this, other five thousands who *think* they can satisfactorily inspect it. One of the chief difficulties in such an inspection is that it is so much easier to satisfy the inspector than it is to prove anything. Not one man in a thousand of those who believe they know a ball when they measure it, but believes if a round body has a diameter through it of constant length, that it is a sphere; and not one ball in ten thousand ever is subjected to another test but that of calipering its diameter.

Most of the commercial balls of metal are made by rolling them between two or more parallel surfaces, and this operation is supposed to produce a perfect sphere.

Here is a round body, Fig. 1, page 2, which has what has been called a "conic ovate" shape, because it has a resemblance both to a cone and to an egg. In this article I shall call it, and a number of other round bodies, simply ovoids, because the conic shape is not apparent in this group of bodies as they approach the sphere in character. The ovoid in Fig. 1 is the extreme to which this kind of round body can be carried in the pointed direction, but bodies of ovate shape, and which fill the definition for this class of bodies, may have any of an infinite variety of outlines between that in Fig. 1 and a sphere.

An ovoid, like a cylinder, a globe or a cone, is concentric to an axial line, and, of course, can be turned in an ordinary lathe. The outline shown in Fig. 1 is that of the plane in which its axis lies, and the outline of the other ovoid to be shown bears the same relation to its axis. To produce this outline in Fig. 1, describe from the apex A with a pair of dividers set to the required length, an arc $B\,C$ of 60 degrees, then from each end of this arc as a center describe two other arcs $B\,A$ and $A\,C$, like unto it, and cutting each other as well as the first arc.

This body, like a sphere, has a diameter of constant length. If measured by a caliper it will be found to be exactly as thick through from any one point to the most distant point on the opposite side as it is through every other diameter. Hence if three or more such bodies are placed on a plane plate, and another plane plate be laid on them so as to be supported by the bodies, the upper plate can be moved about on them precisely as if each were a ball, for the height between the two plane surfaces would be a constant one, whatever positions the bodies

between them should be made to take. It will thus be seen that those who test balls by calipering their diameters are liable to be deceived and can prove nothing by it. No one, of course, would imagine Fig. 1 to be a sphere, and if there were no other bodies of similar form which more closely approach the sphere, there would be no necessity to allude to them at all in connection with spheres as being liable to be confounded the one for the other.

The body in Fig. 2 also has a constant diameter and resembles a sphere in a much greater degree than that in Fig. 1. These bodies may so closely approach the sphere as to almost merge into it and frequently to be indistinguishable from it, except by the closest of inspection. And every body which has a diameter of exactly equal length through all directions from one side to another is an ovoid if it be not a sphere. Hence he who inspects balls by a caliper may be positive; it either is a sphere or an ovate shaped body that fills his gauge alike in all directions through it.

It is a remarkable fact, and it is here only stated as such, that the ovoid in Fig. 1, and perhaps that in Fig. 2, has an outline exactly equal in length to a sphere having the same diameter—the axial outline of the ovoid being 180 degrees of a circle whose radius is the diameter of the sphere, and also that of the greatest circle in the ovoid. This is shown in Fig. 3. The semi circle represents the three arcs of 60 degrees, of which the axial outline of the ovoid is constructed, and the inclosed circle represents the outline of a sphere of equal size as well as the greatest circle within the ovoid. We are to believe that either the superficial area of the ovoid is greater than a ball of equal size or that its volume is less.

It thus is evident that the caliper is no proper means by which a ball may be proved, and it is not possible to use the central point within the ball, as that has no material existence, and it could not be uncovered if it had. We thus are limited to the last, and the only unique definition of a sphere for suggestion which indicates the means to inspect it. "Every section of a sphere made by a plane is a circle," and no other body but a sphere fills this definition. Hence the only means by which a sphere can be inspected for truth is to apply to its surface a circular ring and determine whether every part of the surface of the sphere can come into contact with the ring it lies upon.

A quite perfect ring is fortunately easily made, and therefore that much of the means to inspect a sphere is attainable without much expense. Fig. 4 shows how such a ring should be made and what relation it should bear to a sphere being inspected.

This base is properly made from cast-iron, and the conical ring within it should be finished by grinding. Its surface should be very highly refined both with respect to roundness and smoothness. Its angle may be about 45 degrees. It should support the ball exactly on its upper edge where its flat face intersects the cone. This corner should be rounded. Between the ball and the ring there should be placed in regular spaces four narrow strips of paper carefully selected for uniform thickness. These strips of paper are indicated in the figure. Now, if the ring be true, and that part of the sphere in contact with it be of a circular shape, all four of these strips of paper will be pinched tight; otherwise, one of them will be loose. If they all are pinched, turn the ball partly over, by bringing its top one half way down, or opposite the center horizontally. Then, if all are again pinched, turn the then top down in the direction at right angles to the first turn and try again. Thus, turn the ball down one-quarter turn alternately, in one direction and then in the other at right angles with it, but never re-turn them until the ball is inspected in six places or in the cubical relations. If in these six positions the paper has always been pinched, the ball is true in its general form, but it may be false in local spots. To detect this, place eight or more strips of paper in regular spaces between the ball and ring and turn the ball in regular order to bring every spot on it against one of these strips of paper in the cone in at least two positions. If all are always pinched the ball is as perfect as most earthly things may be.

Care must be had that the contact shall not be within the hollow cone, but be entirely on its upper rounded edge; for if the contact be within it, a variety of other conic sections could touch the cone and produce the same effects by pinching the paper as circles do.

The Japanese crystal ball referred to could be inspected absolutely in the ring in Fig. 4, and whereas doubtless it was burnished within a concave matrix, it cannot be very imperfect. This concave matrix is indicated in Fig. 4; for if the ball in that sketch should be found to be untrue, it could be made perfect by removing the strips of paper and grinding it and the ring together, with fine corundum between them; to be followed by a crocus polishing "slush" with the ring lined by a cloth gasket.

It being evident that all balls made by rolling are more likely to be ovate in shape than spherical, it is certain that means mechanically to perfect spheres is a necessity, and as there are no other means as certain to produce good results as are rings, it is obvious that it is in this direction that the designer of a modern machine to perfect balls will have to work.

Having had occasion, three years ago, to refine some hardened steel balls that were slightly imperfect, the writer made a device the main features of which are shown in Fig. 5. In making this sketch he has put into it such improvements as were then suggested by the operation of the tool; and it is believed that this arrangement will grind to great perfection any suitable sphere that was reasonably uniform when introduced into it. The results got at that time certainly were very fine.

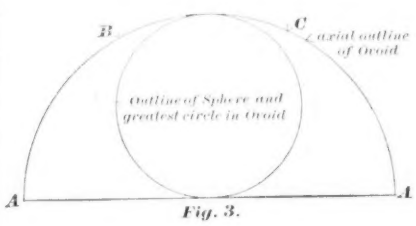


Fig. 3.

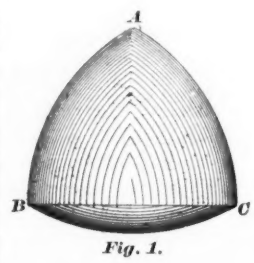


Fig. 1.

Fig. 2.

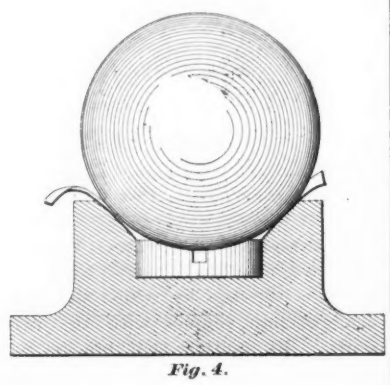


Fig. 4.

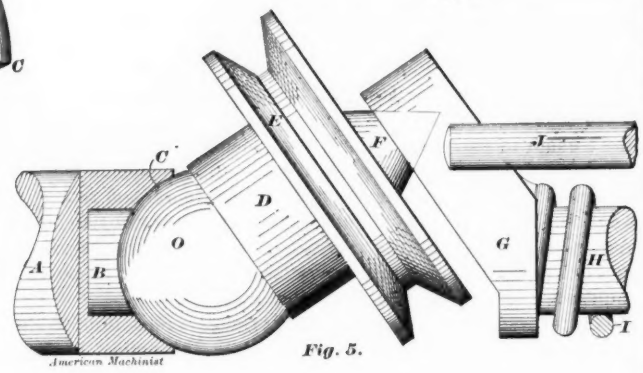


Fig. 5.

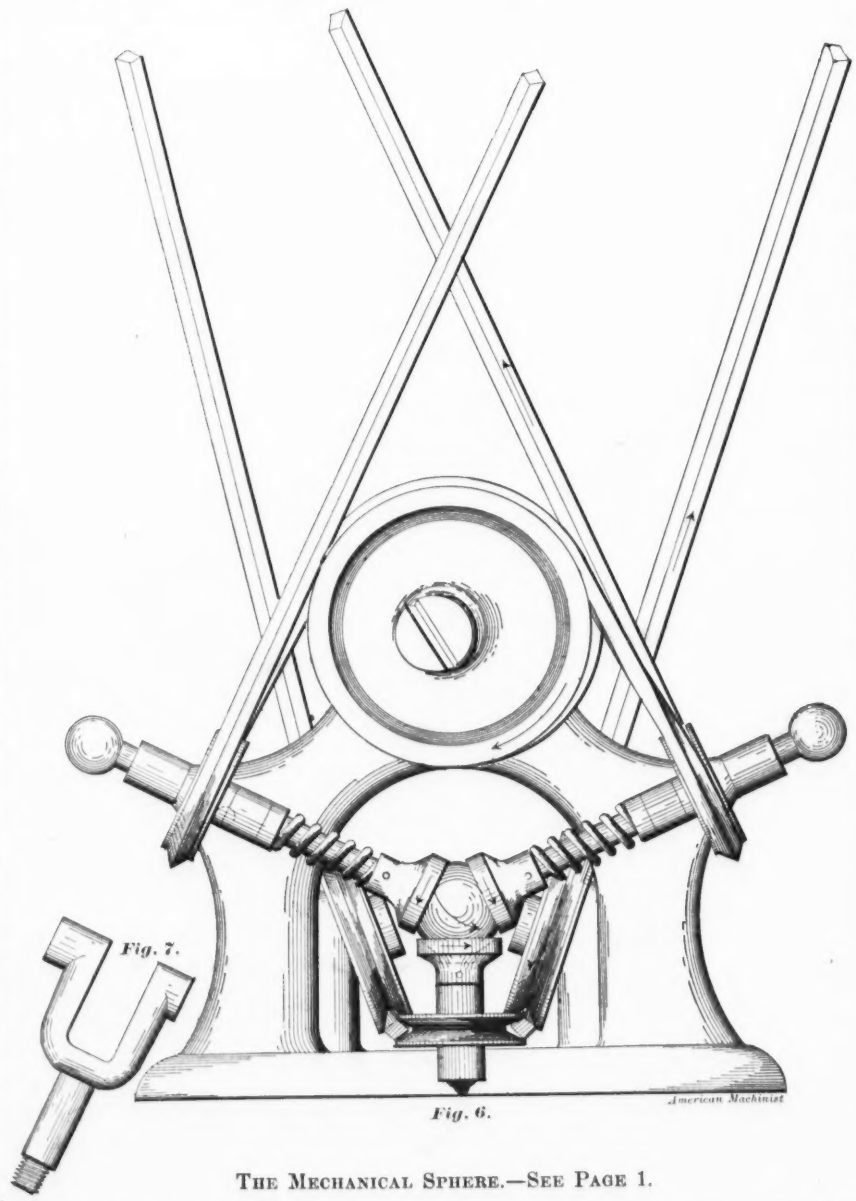


Fig. 6.

THE MECHANICAL SPHERE.—SEE PAGE 1.

The cup *A* is of copper or cast-iron; we used copper, but my present preference is for the cast iron. It is held within a chuck on the spindle of a lathe and turned out concave in position. The concave grinding faces *C*, however, are not to be turned very true in shape, but are ground so by the operation. The chamber *B* holds a quantity of abradant, and some benzine to wash it into the joint; a hole for the introduction of these could be drilled into the chamber through the walls of the cup. The loose cup *D E F* is made from cast-iron and has internal economies like unto the cup *A*. It is designed to be driven by a belt, but the relative speed of this cup we did not agree upon; both cups should be driven in the same direction. The piece *G* is loosely fitted on its shank *H* to a parallel hole attached to the foot-stock and the spring *I* serves to keep it pressed outward and elastically against the center *F*, and hence to maintain a yielding strain on the ball in operation. The dog *J* serves the purpose of preventing the rotation of the piece *G* which the friction of grinding tends to produce. This dog is a part of the piece attached to the foot-stock into which the shank *H* is fitted. In operation, the ball *O* will be made to present every part of its surface to the grinding cup, and if there be no protuberance to arrest the motion in any direction every part will be ground or polished a true sphere.

In Figs. 6 and 7 is indicated a method of perfecting balls where great accuracy of the spherical character may be required; for instance, billiard balls, where the expense of perfection is justified by the result. For it is on our luxuries that we can afford to expend enough to warrant satisfaction.

I believe this sketch is well able to talk to intelligent people, and because nothing but the idea is intended to be indicated there will be no extended description of it offered. The ball in process of being finished is held within three revolving rings having as much as possible a general direction in their motions, and will take the mean direction between the combined rotations of the supporting rings and thus be turned about in all positions and surely be ground or polished toward perfection.

Attention is directed to the square belts indicated in this sketch. They are found to be easily made and to have a good driving power. Those I have used were made by a rawhide belt company in Chicago.

Col. Albert A. Pope, of Boston, whose interest in and work for the improvement of roads we have before mentioned, has proposed to the management of the World's Fair that a department be formed in which the advantages of good roads, with the various methods of making them, can be fully shown. The prospect for securing a separate building, and making an exhibit proportionate to the importance of the matter, does not seem very bright; but there will probably be something done in that direction better than having the machinery and other things pertaining to road making scattered about the grounds in five separate buildings.

Col. Pope proposes to give $1,000 toward the expense of such an exhibition as will do the subject justice, and it is to be hoped that much may be accomplished in that direction before the opening. Such an exhibition ought to have a very great educational effect upon the many benighted Americans who will visit the show, and whose idea of a road is that it is simply a right of way between two fences.

It is suggested also that the national government should construct interstate roads in the best possible manner; and this would probably have a good effect upon the art and practice of road making in this country, though it is doubtful if there is as good reason for the national government doing such things now as there was formerly, when there were no railroads, and military roads might therefore at any time be needed.

To Mold a Spiral Post.

BY S. BOLLAND.

Post molding seldom claims much attention, such work being usually considered beneath the notice of molders who have graduated with high honors; but here is one, I think, which demands careful examination before it is passed over as a common job.

Fig. 1 represents the post, which is seen to be a spiral figure composed of two strands ¾" diameter, interlacing each other and separated by the distance of ½". The total length is 2 feet, the ends being solid and 2" diameter.

If the reader will observe Figs. 2 and 3 he will at once see how almost impossible it would be to make this job, by using loose cheeks, in green sand. Fig. 2 shows the form of the joints at that particular place, where the two spirals set parallel, and Fig. 3 shows the altered form of the joints when the pattern is at an angle of 45 degrees. We will assume the ever-changing form of the joint intermediate to these positions shown, and decide that, however careful we might be, the job, if made in green sand, would be at best but a very rough one.

It is my purpose here to show how best and cheapest to obtain a set of core boxes from which good cores can be made and joined together in such form as will, by the use of a block print on the pattern, as shown at Fig. 4, make the job a very simple one.

In this instance the block prints might extend beyond the spirals at the ends, leaving only the plain ends out; but, as will be seen further on, I have other motives for making the junction as shown, and do not desire to make other drawings.

Fig. 5 shows section of a wood box, the inside dimensions of which correspond to the size of the block print on pattern, the ends being made to receive the pattern in such position as will, when the four cores are joined, make a perfect fit at the ends.

The first process is to fill all the lower part of the box with clay, as seen at *A*, and proceed to form the whole joint along the pattern, as seen at *B*, after which oil over the surface and fill space *B* w ith plaster.

After giving due time for the plaster to set hard, the position of the box can be changed, and each side treated similarly, when you will have four plaster casts answering in form to Figs. 2 and 3.

It only remains to separate the four parts, and take a plaster cast of each, as seen at Fig. 6, and the core boxes are made, which, with ordinary care, will produce cores as true as the plaster casts from which they were made.

The pattern when made must be separated diagonally, as shown at Fig. 7.

Another mode of molding such a job is to have the spirals separate, made of steel and very accurately finished to a slight taper. Tight iron boxes, the outside dimensions of which must be made to correspond with the block print *A*, Fig. 4, provided with adjustable ends through which the ends of the spirals must protrude, allow for ramming the spirals within the box in green sand.

The patterns can then be twisted out endwise, and the ends of box taken off; it is then ready for the mold, which, as in the other case, is best if made diagonally, as seen at Fig. 7.

The latter method facilitates production to a considerable extent, but, owing to cost of preparation, is not to be thought of unless the order is a very large one.

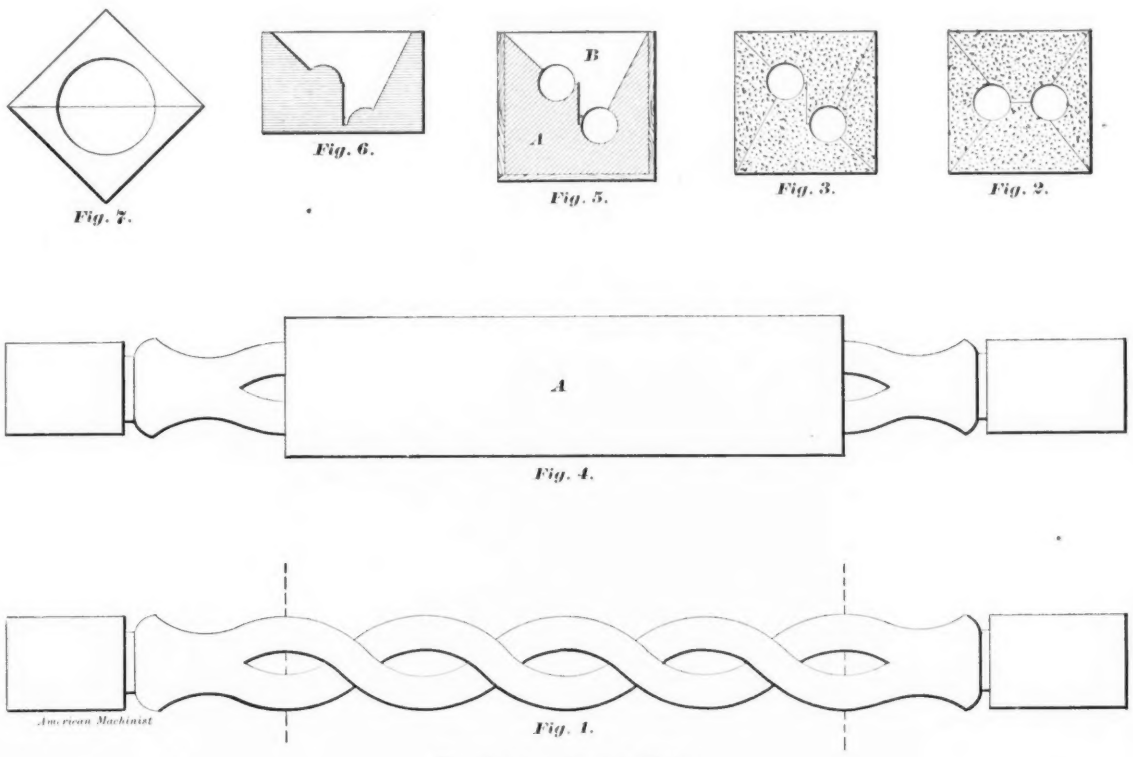


Fig. 7. Fig. 6. Fig. 5. Fig. 3. Fig. 2. Fig. 4. Fig. 1.

TO MOLD A SPIRAL POST.

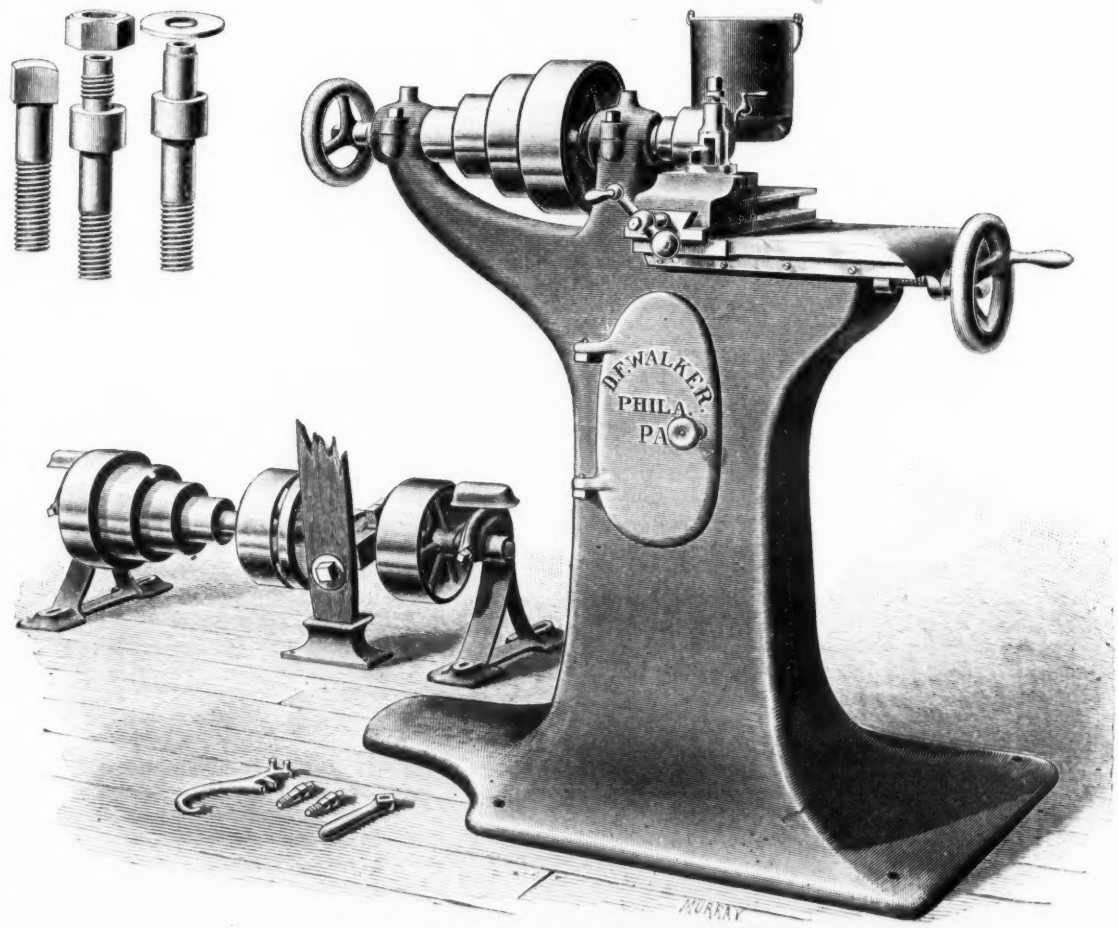
Bolt, Nut and Washer Finishing Machine.

The accompanying illustration is of a machine made especially for finishing the heads of bolts, nuts and washers.

As will be perceived, the machine is a modification of the lathe, and consists essentially of a substantial column upon which the head stock is cast solid, and to which is also fitted by broad sliding surfaces a slide rest moved by the screws as shown.

Within the spindle, which is hollow, there is a sleeve, to the outer end of which is attached the small hand-wheel at the left. This sleeve is threaded internally at the other end, to receive a short arbor for the nut or washer to be finished, and when this has been done it is only necessary to place the hand on the hand wheel to retard its motion, when the bolt or arbor is released, and can be removed and another one substituted without stopping the machine. The operation of the machine is thus quite rapid, and the machine is very efficient.

It is built by D. F. Walker, Philadelphia, Pa.



BOLT, NUT AND WASHER FINISHING MACHINE.

The New Municipal Electric Station at Copenhagen.

The large new central station for electric lighting at Copenhagen, which has been erected by the corporation—likewise the owner of the principal gas works—is now completed, and electricity was first turned on on March 5. The station, which has a working pressure is 140 pounds. There are three vertical compound engines, with condensers, one of 330 and two of 550 horse-power each, their respective speed being 130 and 120 revolutions per minute. There is further room for two engines of 1,000 horse-power each. The engines, with condensers, were supplied by the well-known local firm of Burmeister & Wain's Shipbuilding and Engineering Company. The water for condensing is taken from the nearest part of the harbor, through a cast-iron pipe. Two dynamos, with interior poles and externally rotary armatures, are coupled directly to each engine; the small dynamos have a capacityof 1,500 lamps, the larger of 2,500 lamps each. From the switchboard proceed 13 feeder cables, each cable consisting of a positive, a negative, and a zero cable. From the terminus of each of these cables proceed again two or three main cables, which end in the distribution mains. All the distribution cables are mutually connected with each other, so that any interruption will not cause the consumers inconvenience. The cables are almost all lead-covered, with iron hoop protection, from the works of Siemens & Halske, Berlin, who are the contractors for the electric plant of the Copenhagen central station. In a few streets the cables have no sheathing, but lie in cement conduits. The cables so far laid have a capacity of 20,000 lamps, and an aggregate length of 90 kilometers. The accumulators consist of 272 elements, and have a capacity equal to the supply for 3 000 lamps for three hours. The battery has its place in the basement, and is capable of being extended 33 per cent.

The accumulator has been supplied by the Accumulatoren Fabrik-Actiengesellschaft Hagen, in Westphalia.—*Engineering.*

Some remarkable figures have lately been published with regard to a 150-light installation in some large steam mills in Barrow-in-Furness. The installation was laid down in 1885, and includes a Mather & Platt dynamo, driven off countershafting from a horizontal Marshall engine, supplied with steam at 65 pounds pressure from the mill boilers. Taking the average for the six years, we have the following figures: Annual cost, £92; cost per lamp hour, .059d. The price of gas in Barrow being three shillings per thousand, the annual cost of an equal number of No. 5 burners consuming 5½ cubic feet per hour would be £314. If we take the 16 c. p. Edison-Swan lamp as consuming on the average 80 watts, the lamp hour at .059d. is equivalent to the Board of Trade unit at ¾d., the price charged per unit in London being 7d. to 8d. The average life of each lamp at this phenomenal mill comes out at 3,484 hours, and there are two or three of the originally installed lamps still burning which have run for 20,000 hours.—*Electrical World.*

It is not often that passengers beat off train robbers, but this appears to have happened at Wallace, Kan. As the train pulled into the station it was attacked by the robbers, when the passengers rallied and drove them off.

Naval Academy Practice Cruiser "Bancroft."

The Naval Academy Practice Cruiser was successfully launched from the yards of Samuel L Moore & Sons Co., Elizabeth, N. J., on the 30th ult.

The hull was designed under the direction of T. D. Wilson, Chief Constructor, U. S. N., Chief of Bureau of Construction and Repairs; and the machinery was designed in the Bureau of Steam Engineering, under the direction of Commodore Geo. W. Melville, Engineer-in Chief U. S. Navy, Chief of Bureau.

A complete set of specifications was furnished by these departments for the guidance of builders in getting out a part of the detail work.

The design of this Practice Cruiser and the excellent workmanship throughout, will undoubtedly commend it to the most critical of mechanics and naval architects.

With this we merely give illustrations of the hull; in another issue we shall give illustrations of the machinery.

The "Bancroft" is a steel twin screw propeller with barkentine rig, spreading 5,000 square feet of canvas.

The length between perpendiculars is 180 feet 9⅜ inches; breadth extreme, 32 feet; displacement (normal draught 11 feet 6 inches), about 838 tons. All the material used in the construction of this vessel is steel, unless otherwise described, conforms to the requirements specified in the instructions to steel inspectors; and all material is of the best quality.

The propelling power is furnished by two engines, right and left, placed in a common water-tight compartment. These engines are of the vertical, inverted-cylinder, direct acting, triple-expansion type, each with a high-pressure cylinder 13½ inches diameter, an intermediate pressure cylinder 21 inches diameter, and a low-pressure cylinder 31 inches diameter; the stroke of all the pistons is 2) inches. It is estimated that the collective indicated horse power of propelling, air-pump, and circulating pump engines is 1,300 when the main engines are making about 240 revolutions per minute. Steam will be furnished by two straightway fire tubular boilers 8 feet 9½ inches outside diameter and 17 feet long. The total grate surface, 78 square feet, and the total heating surface 2 640 square feet. The boilers are tested to a pressure of 250 pounds to the square inch above the atmospheric pressure; working pressure, 160 pounds.

The dimensions of the principal parts of the hull are as follows:

The vertical keel is made of plate-steel, 15 pounds per square foot, and is 29½ inches deep.

The stem is made of wrought-iron, 6x2½ inches, rabbeted to receive the ends of the bottom plating; the lower end is well scarfed to the vertical keel, and side bars to keel.

The stern post and stern-frame are of cast-steel, well scarfed to the keel plates.

The rudder is made of wrought-iron, and shaped so as to form a continuation of the lines of the hull.

The side plates of rudder are of steel, 12½ pounds per square foot, and filled in between with white pine. The least diameter of the head is 9 inches, exclusive of brass sleeve.

Shaft tubes for the reception of the propeller shafts are constructed on each side of vessel. At the forward ends these tubes are worked into the form and frame-work of the hull; they are made of cast-steel, and provided with flanges or lugs on the tubes. They are strongly fastened to the framework of the vessel, and permit an easy passage of the water over the junction of the tubes with the hull.

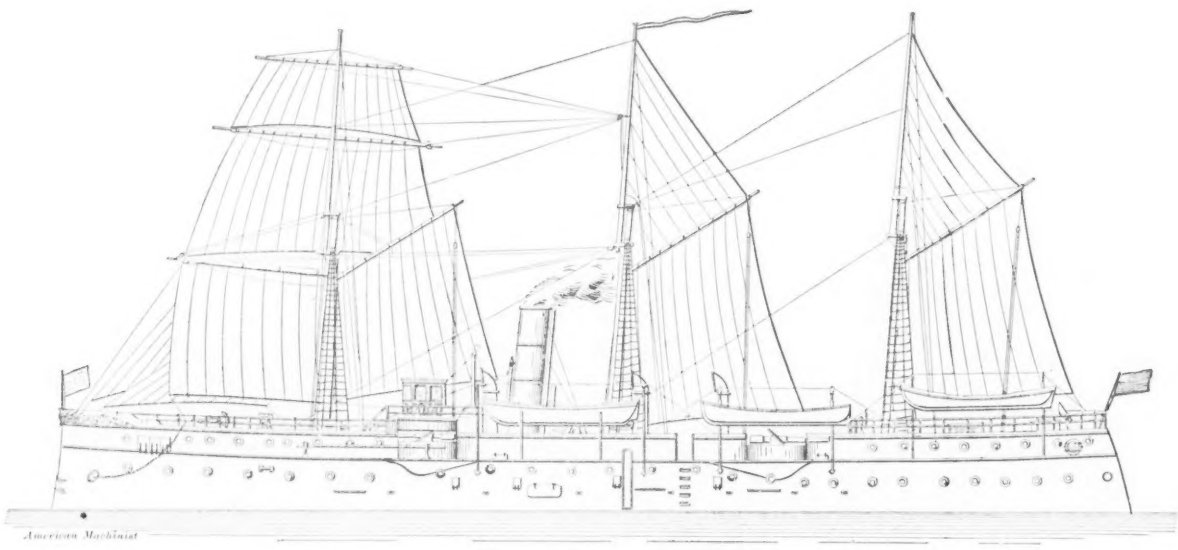
The aftershaft tubes are made of plates about 10 pounds per square foot, and are not made water tight. The shafts and tubes are supported at the after ends by a strut on each side; these struts are of cast-steel; their upper and lower ends are broadened out and securely riveted to the bottom plating and stern-post. The struts are of pear-shaped section, with their thin ends aft.

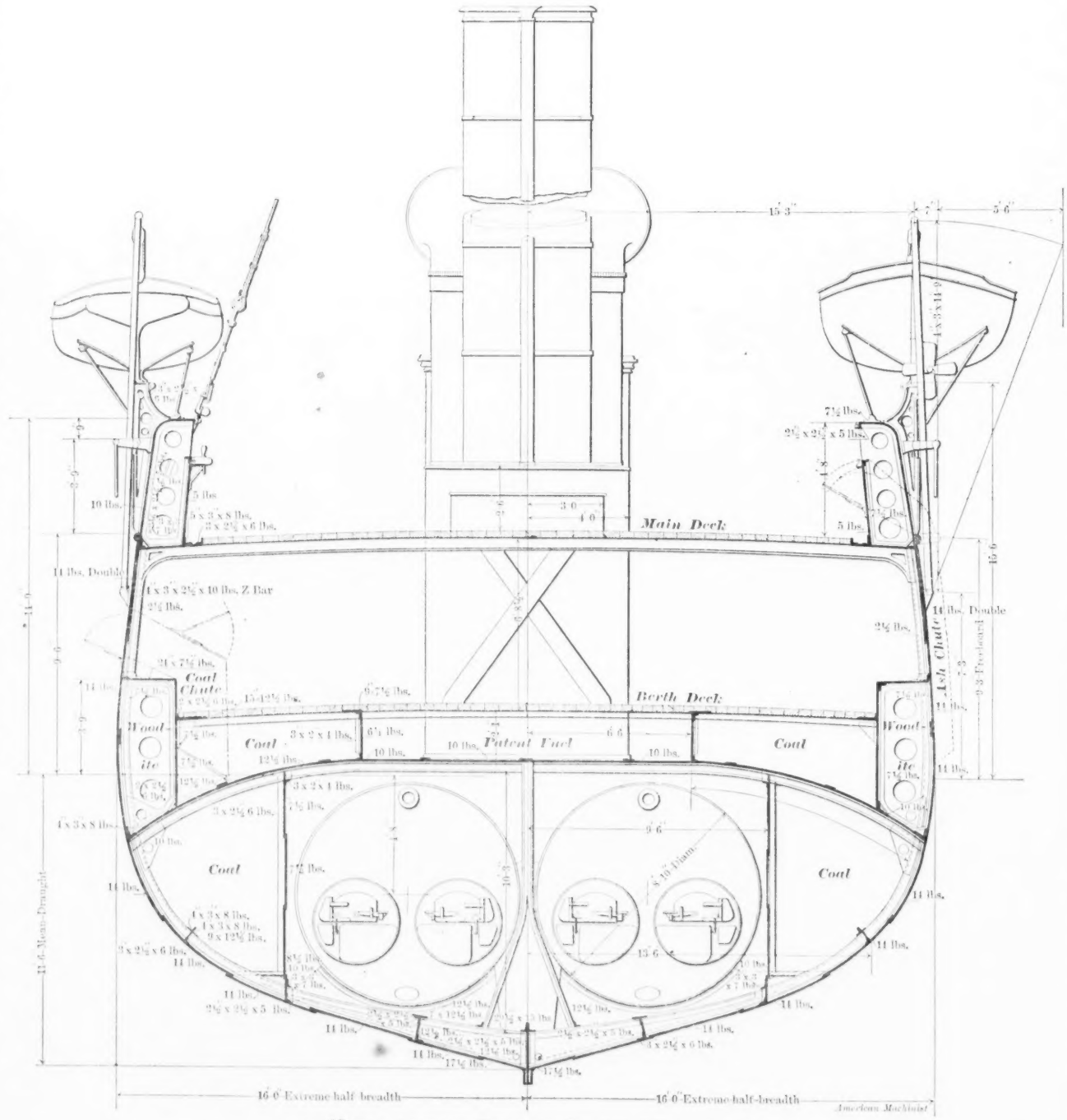
The transverse frames are spaced 21 inches from center to center throughout the length of the vessel. From frame 34 to frame 78 inclusive, below the water-tight deck, the frames are formed of Z-bars 5x3x2½ inches of 12.4 pounds per foot; they are split up from the middle line to the lower turn of bilge; between the top and bottom flanges floor plates are worked to make the floors generally 17 inches deep next to the vertical keel, to which they connect by angle clips 3x2½ inches of 6 pounds per foot. Above the water-tight deck, from frame 34 to frame 78 inclusive, the frames are formed of Z bars 4x3x2½ inches of 11.1 pounds per foot, and secured to water-tight deck by flanged brackets 10 pounds per square foot. From frame 33 forward and from frame 79 aft, the frames are formed of Z bars 4x3x2½ inches of 11.1 pounds per foot; these Z bar frames are not split; the reverse flanges are cut off where the Z-bars extend below top of floor plates.

Angle bars 2½x2½ inches, of 5 pounds per foot, are fitted to the top of all floor plates at the vertical keel, passing through scores in the keel plate and riveted to the rider plates and floor plates; these bars extend about 9 feet each side of center line; in the engine and boiler space forward and abaft they are 30 inches in length, 15 inches each side of vertical keel. The floor plates from frame 47 to 70 inclusive are 12½ pounds per square foot; from frame 27 forward and from frame 79 aft they are 8½ pounds per square foot.

There are three longitudinals on each side of vessel below the water-tight deck. The first longitudinal from keel on each side of the vessel extends from frame 17 to frame 77, and is formed of intercostal plates of 12½ pounds per square foot; these plates are connected to the outside of plating by angle bars 3x2½ inches of 6 pounds per foot. On the reverse Z bar frames at the top of this longitudinal, rider plates 12½ pounds per foot by 7 inches wide are worked; the butts of the continuous rider plates are secured by double riveted butt straps. The rider plate is connected to the longitudinal by intercostal angle bars 2½x2½ inches, of 5 pounds per foot.

The second longitudinal from the keel on each side of the vessel is formed of intercostal plates 10 pounds per square foot, and extends within the frames 5½ inches for the length of the fore-and-aft coal bunker bulkheads; the butts are closely fitted above the reverse Z bar frames; they are connected to the floor plates, outside plating and fore-and-aft angles on top of Z bar frames by staples 2½x2½ inches; the fore-and aft top angle bars are 3x3 inches, of 7 pounds per foot. Before and abaft the fore-and-aft coal





NAVAL ACADEMY PRACTICE CRUISER "BANCROFT."

bunker bulkheads these intercostal longitudinal plates are gradually twisted from their vertical to a position square to the outside frames; they are formed of intercostal plates 8½ pounds per square foot, and extend within the frames 3 inches, and have double angle bars 3x3 inches, of 7 pounds per foot, worked on the upper edge, connecting the same to Z-bars. These longitudinal extend forward and connect with water-tight flat at frame 7; the after ends extend to frame 83; angle bars of 2½x2½ inches, of 5 pounds per foot, are worked on the lower edge of plates to connect the same to outside plating; the outer flange is worked continuous on outside of frames.

The third longitudinal from keel on each side of vessel is of 12½ pounds per square foot, connected to the outside plating similarly in all respects as required for the first longitudinal, except that it extends within the frames 4 inches, and has double angle bars 4x3 inches, of 8 pounds per foot, worked on the upper edge, connecting the same with the Z-bar frames; they extend forward and connect with breast-hook at frame 7, and extend aft and connect with water-tight flat at frame 95.

The outside plating is worked as shown on the midship section; the weight of garboard is 17½ pounds per square foot; the weight of the other plating is given in the section. The plating is worked lap jointed from the keel to the water-tight deck; above it the plating is flush-jointed. The flush-jointed and lap-jointed plates are single-riveted at the edges; the breadth of the edge strip is seven times the diameter of the rivets. All plates are double riveted at the butts, the breadth of strap is 11½ times the diameter of rivets; all plates ending on the stem and stern-posts are double riveted thereto. All butt straps and edge strips are of the same quality and thickness they connect.

Forecastle and poop-deck beams are of angle bars 4x3 inches, of 7½ pounds per foot. There is a beam on every other frame, each having a spring of 5 inches in a length of 32 feet; the ends are connected to Z-frames by 10-pound gusset plates. Main deck beams are of the angle-bulb pattern 6x3 inches, 15 3 pounds per foot. A beam is placed on every frame between frames 34 and 78; forward and abaft these frames there is a beam on every other frame; each has a spring of 5 inches in a length of 32 feet.

The berth deck beams are formed of angle bars 4x3 inches, of 7½ pounds per foot. Water-tight deck beams are of the angle-bulb pattern 5x2½ inches, of 10 pounds per foot.

The water-tight deck plating over engine and boiler extends from frame 33 to frame 79, of 10 pounds per square foot between the longitudinal coal bunker bulkheads, and 12½ pounds per square foot from these bulk heads to the sides of vessel.

Water-tight flats are located from frame 7 forward, and from frame 89 aft; the plating is of 10 pounds per square foot, and made thoroughly water-tight.

The bottom strakes of the transverse water-tight bulkheads (except stuffing box and collision bulkheads) are 8½ pounds per square foot; all other plates below berth deck are 7½ pounds per square foot; all plates above berth deck 6½ pounds per foot. The stuffing box bulkhead is of 12½ pounds per square foot. The collision bulkhead is of 10 pounds per square foot below the berth deck, and 7½ pounds per square foot above berth deck. Coal bunker and fore-and-aft bulkheads have the lower plates of 8½ pounds per square foot; other plates below the berth deck, 7½ pounds per square foot; all plates above berth deck, 6½ pounds per square foot.

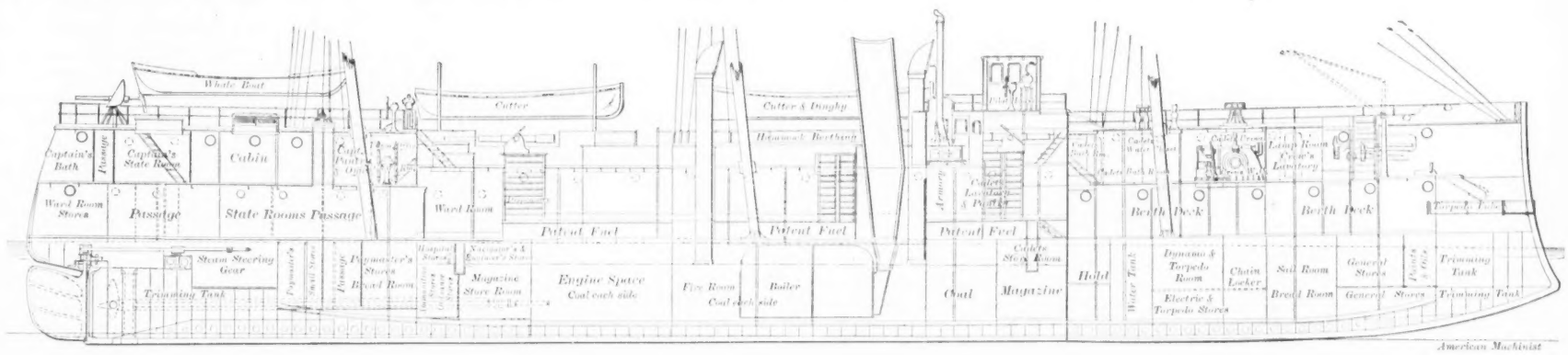
The hull of the "Bancroft" is divided below the water-tight deck into 20 water-tight compartments, including the coal bunkers, which are so arranged on either side of engine and boiler space as to form a protection for machinery. In the wake of machinery and magazines the water-tight deck is rounded over to deflect shot; at the sides of vessel, and for a length of about 80 feet amidships, there will be a belt of cellulose packed in water-tight coffer-dams. The belt will extend for 2 feet 6 inches below to 3 feet 9 inches above water line.

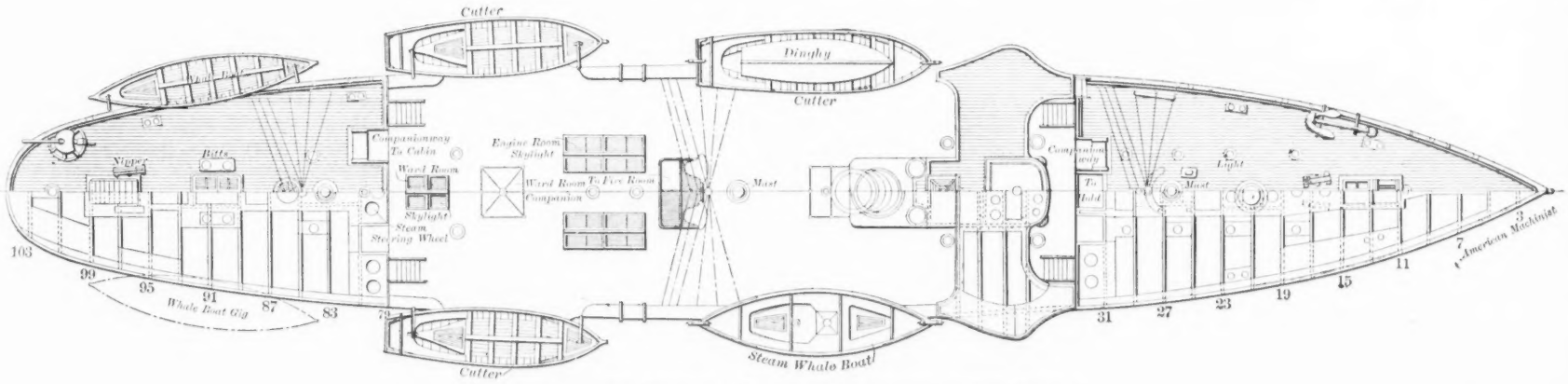
The captain's quarters aft under poop are finished in quartered oak. The ward room aft on berth deck, with eight state rooms, are finished in white ash.

The crew's quarters are amidship, and cadets' forward on berth deck. Special arrangements are made for the comfort of the cadets—large lockers, stationary tables, well-arranged pantry and lavatory are provided.

The pumping, drainage and ventilating systems will be of the most improved construction, the latter having been given particular attention. The ventilation of all living and hold spaces is obtained by means of a blower arranged to exhaust the vitiated air with fresh air pipes leading down from top sides.

The battery will consist of four 4-inch rapid fire guns arranged in sponsons, two 6 pounders forward and two 3 pounders aft. The secondary battery will consist of one 57 M. M., one gattling, and two 1-pounder guns. There will be two torpedo tubes, one at stern and one at broadside for discharging auto-mobile torpedoes.





NAVAL ACADEMY PRACTICE CRUISER "BANCROFT."—SEE PAGE 4.

Crucibles for Brass Melting.

BY ALEX. CAIRNS.

The black lead crucible being the acknowledged standard in use among brass foundry men, reference will be made to that class in particular, although the difficulties met with in using the black lead crucible are common to the lime and clay crucibles.

Generally speaking, then, the principal trouble found in using crucibles arises from a general lack of knowledge of their action when suddenly heated under ordinary circumstances.

Being of a porous nature, they absorb dampness or moisture very readily, from which fact the most common defect originates, which is known as flaking. In appearance flake is a scaling off of parts of the bottom of the crucible, being in principle and action similar to the cutting or scabbing of sand in a mold, which in both cases depends on the amount of dampness in the mold or crucible. In other words, it is the too quick application of heat to a crucible containing moisture, and the consequent sudden generation of steam which does not have time to escape, that is the cause of flaking—it is caused then simply from placing a crucible on the fire before it is dry.

Manufacturers invariably recommend annealing, toasting or drying crucibles before using the first time, as they are liable to absorb moisture in transit, and it is inferred, of course, that they are kept dry in the shop, which is the exception rather than the rule.

Careful observers have noticed that crucibles last longer in the summer than in the winter, in dry than in rainy seasons, which fact is due solely to there being more dampness absorbed by them at these times, which, as before mentioned, produces flake, not necessarily the first time they are used, but at each subsequent time, the difference being that the flaking is not as large after the crucible has been baked as it is on using for the first time.

In shops where little attention is paid to this subject they are usually left on the ground, brick floor or iron furnace top, where they get damp through the night, especially in rainy seasons; in the morning they are filled with gates and ingots, and almost immediately placed on the hot fire, which causes them to flake from the too sudden application of heat to the moisture in them.

It will be evident by this time that the one thing necessary to insure the crucibles lasting as long as possible, is to be sure they are dry before using.

To guard against any danger of their containing moisture when about to be used, each crucible should be placed in its corresponding furnace, mouth down, at the time of starting the fire in the morning; they will then dry gradually and not suddenly enough to produce flaking, and can be allowed to get to or above a red heat, when they can be taken out, filled and returned.

The tongs used to lift crucibles from the furnace are familiar to every one, and need no special comment other than that the lower fingers should have the bearing on the crucible, the upper ones being used only to steady it.

The contents of crucibles vary according to the maker. A standard black lead crucible* will hold three pounds of molten metal to the number, and should, with ordinary good care, last from thirty to forty-five heats.

A recent press dispatch says: "Passengers on Erie train No. 5 brought the news of a strange accident that happened to the train at Salamanca, N.Y., yesterday. It was about three o'clock in the morning, and the train was rounding a curve just east of the city, when it struck a heavily loaded car which projected over the main track. It caught the corners of the coaches and tore out the entire side of each one of them. All of the cars were vestibuled, and several of them were sleepers filled with people, yet not a passenger was injured.

The 200 passengers all left the cars in their night clothes, and there was great excitement for a while. No. 5, known as the vestibule flyer, runs from New York to Chicago. It was delayed about two hours while a train of day coaches was made up and the journey continued.

Considering some of the claims that are being made now, it may be well to recall the fact, says the London *Engineer*, that during the electrical exhibition of Turin, Italy, in 1884, there was in operation a transmission of power from that city to the city of Lanzo, a distance of 10 kilometers—6¼ miles. The wire was four millimeters in diameter, or about No. 6, B. and S. gauge. The alternate current dynamo generated 10,000 volts. At Lanzo the power was used to run 60 incandescent lamps of 16 candle-power, and one arc lamp. At Lanzo there were four transformers of the Gaulard and Gibbs type, in addition to a special one for the arc lamp. On the 25th of September, in the presence of the international jury, it was found that the efficiency was 89 per cent. Messrs. Gaulard and Gibbs were awarded the grand prize of 10,000f. by the Italian government.

*Dixon's.

LETTERS FROM PRACTICAL MEN.

Are American Engineers and Builders Boastful?

Editor American Machinist:

I have carefully read the paper entitled, "American Boasting," also the editorial remarks of the AMERICAN MACHINIST on the same, and propose to answer a few of Professor Sweet's questions.

First let me say that I am surprised that Professor Sweet should have selected the American automatic *horizontal* steam engine as a shining mark for adverse criticism, as he is supposed to know its history thoroughly. Mr. George H. Corliss established his rights as the inventor of the detachable valve gear, automatically moved by a governor or regulator, between the years 1853 and 1858, in his famous suits against Thurston and Green, builders of the Green automatic engine at Providence, R. I. At that time there was no *real* detachable valve gear in existence outside of the United States, the nearest makeshift to this device being what was then known as the French conical sliding cam, operated by the governor, but *never* de ached by it. Mr. Corliss not only established his right to the valve-releasing mechanism by the action of the governor, but also his sole right to arrest the valve when closing by a dash pot filled or partly filled with "*air, water, or any other fluid.*"

In the year 1855 certain parties in this country began to use the French cam on steam engines, but they soon learned to their cost why this method of operating steam engine valves had not been generally adopted in Europe. This cam was usually made of tool steel, and hardened, but even with this precaution it was soon worn in one or two steps, or shoulders, and at the end of six or eight months the governor would, of course, fail to move it. The chief trouble, however (to use a little of the language of Professor Sweet), was that this detachable valve gear *did not detach;* it simply allowed the valve to gently slide down hill, so to speak. When the celebrated Corliss-Green suit was pending, the writer saw in court some models of so called European valve gears that the Green party and others interested in the defeat of Mr. Corliss had procured for the purpose of antedating the Corliss patents; but as the United States Court decided in favor of Mr. Corliss, it is safe to say that the European valve gears did not count for much *then.*

I would like to ask Professor Sweet if he claims that the girder bed, used so long by Mr. Corliss, was designed in Europe?

Who first used wide leather belting for transmitting power—the English, the French, the German, or the Yankee? My memory may be defective, but I think the Yankee was a long way ahead in belting, and other economical transmission.

We have not made many firearms in the United States since 1866, but does Professor Sweet mean to say that at *that* date English, German, French or Austrian small firearms were anywhere near equal to those made by nearly a dozen builders in this country?

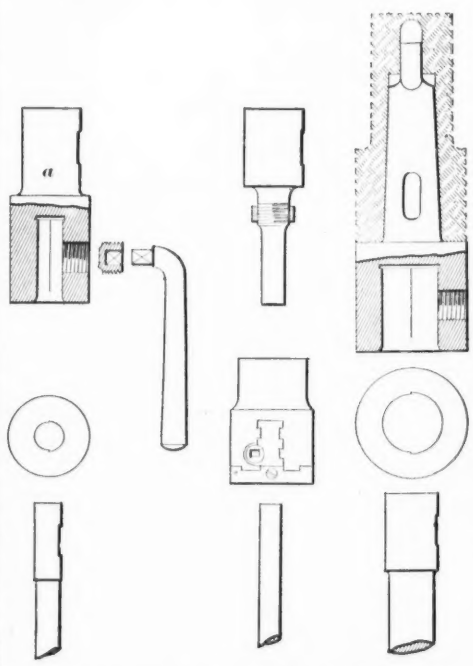
Professor Sweet says: "A better built Corliss engine than was seen in this country was exhibited at the Paris Exhibition, built at Creuzot—an engine with work about it that no American could even tell how it was done"; but he does not say that this extraordinary display of skill was necessary to the economical operation of this engine. The Professor also fails to enlighten us as to whether any citizen of this globe, other than a poor unskilled American, could fathom the awful mystery of construction involved in this particular case.

I freely admit that some of our machine tool builders are afraid of a little pig-iron, costing say $18 per ton, but when it comes to ingenuity and general design I will not admit that the American tool builder is behind the European. While on this subject I will mention a few tools that were *wholly* invented in this country—the special car axle lathe, car wheel borer, car box borer, punching and pressing machines with automatic stop motions, the complete set of machinery for making gun stocks, invented by the late Cyrus Buckland, of Springfield, Mass., benches for drawing seamless brass tubes, revolving crucibles for pouring copper ingots, punching presses for making steel railroad ties, the best power hammers and drops in the world, machines for producing twist drills and other spiral work.

I propose to continue this list, but not here, as I wish to say something about boasting. Do we boast? if so, how much? Do we boast as much as Englishmen, for instance? Englishmen are making one hundred tons of pig-iron daily in furnaces large enough for a 200-ton output. They use about 2,600 pounds of fuel per ton of iron, against our 1,900 pounds.

They began to adopt the stationary multitubular boiler about fifteen years ago, and it had then been in use here thirty-five years. They did not invent the sight-feed cylinder oil cup, nor the best cylinder packing rings, nor the best anti-friction metals.

Professor Sweet may have thrown down his challenge for the purpose of inciting discussion, and if that is his motive I for one am glad that he has "opened the ball," for I think it is time that the American public should know that there are real designers, inventors and builders on this side of the Atlantic. OBSERVER.



Drill Sockets in an English Shop.

Editor American Machinist:

Referring to our conversation regarding drill sockets, it is a system which I have adopted throughout for drilling machines, and to a great extent for milling machines at the works of Messrs. Willans & Robinson, Limited, Thames Ditton, England.

The sockets are made of a specially mild quality of open hearth steel which will stand case hardening without any danger of developing cracks after machining; the sockets are thoroughly case-hardened all over and in the bore, and finally ground up true all over in a Brown & Sharpe universal grinding machine, and the half-bore of socket is also ground out truly.

On referring to the cuts it will be seen that the bore of the socket is cut away round one side. This is to provide that a shank of the full size can be readily inserted or withdrawn, the set-screw, which is of malleable cast-iron, binding it firmly against the true half bore.

If there is a burr on the shank of the drill or other tool, or if it is either slightly big or small, it can still be inserted, although it will not then run quite true. The sockets being well-hardened, no damage will be done to them.

Flats are cut on the shanks of drills, etc., as usual, to allow for driving, and as the flat is only at the middle part of the shanks the tool will not drop out on the set-screw being slacked back until the set screw is drawn back sufficiently far. This prevents the drill or tool dropping on its point while both hands are engaged in setting back the set-screw.

The set-screws are flush with the sockets, and thus offer no projection for catching clothing, etc. The illustrations will show the arrangement of a complete set of sockets—a giant chuck being used for all sizes of $\frac{5}{8}$" and below.

These sockets have been in use for some time at Thames Ditton, and have given entire satisfaction. They are well up to the heaviest work required of a drilling machine, such as tapping holes and setting studs.

Before these sockets were adopted the Morse system was in use. The writer, however, found some serious objections to the use of the Morse taper shank, and the above system was devised to obviate them.

To begin with, the Morse shank and sockets take up a considerable length, thus reducing the effective head room. To allow for under-cutting, a second slot and cutter or similar device must be adopted, being expensive and still further reducing head room. If the Morse sleeves are adopted, besides the inability to under-cut or with draw tools, the sleeves have to be knocked out one after another to remove the tool, thus wasting time and injuring the sleeves.

In the usual run of drilling machine work, such tools as boring bars, countersinks, cutter bars, taps, stud setters are used quite as much as drills. It would be very expensive to make all these tools with the Morse taper shank, and consequently the drilling machine men usually have, in addition to the Morse sockets, a set of parallel sockets of home make for carrying odd tools and bars.

The system above described does away with the need for these home-made sockets, and, in the writer's opinion, provides for all the requirements of a drilling machine with the minimum interference with head room, and effects a saving of expense in tools, as the parallel shank can be made more readily and cheaper than the Morse taper. The writer is aware that many of the advantages claimed are common to the ordinary parallel shanks and sockets already in use. J. C. PEACHE.

[The system as shown by Mr. Peache's sketch includes three other sockets like *a*, and having the same size shanks, but larger holes for the reception of drills. —ED.]

Wants Information.

Editor American Machinist:

I am running a number of molding machines and have them set in line at one side of foundry. I want to convey the molding sand from all machines to one end of foundry under the floor after each cast, mix it there, elevate it, and convey it back to a hopper over each machine, where it can be dropped into flask by opening a slide.

Now can you inform me of some practical way to convey the sand under floor, or is there anything better than a belt for such purpose? J. A. L.

[Perhaps some of our correspondents can help J. A. L.—ED.]

Wants Information About Valves for Gasoline.

Editor American Machinist:

I experience great difficulty in making a check valve that will hold gasoline. I have had several made of brass, cut at an angle of 45°, with $\frac{1}{16}$" to $\frac{1}{8}$" in seat, all ground and fitted with the utmost accuracy, and yet they would not hold gasoline. I recently saw in a book on pumps that valves for naphtha, etc., should be made of cast iron; has this any advantage over brass? What grinding medium would you advise to make a tight joint? Could some of your readers suggest or give a description of a valve to answer my purpose? E. J. C.

Writing on Blue-print Paper.

Editor American Machinist:

It is pretty generally known among master mechanics and draftsmen that you can write on blue-print paper with a solution of soda and water, the writing coming out white; but I believe that it is not generally known that you can write equally as well with red ink if a little caustic soda has been dropped into the red ink bottle. Inclosed is a little sample of blue-print paper, on which you will observe the clearness and distinctness of the red ink. A little piece of caustic soda, about as large as an ordinary white bean, is sufficient for a bottle of red ink, such as draftsmen use, or the ordinary desk size bottle. Thinking this may interest some of your readers, I take the liberty of writing. J. D. COX, JR.

Cleveland, Ohio.

American Boasting.

Editor American Machinist:

I have read Prof. Sweet's article under the above title with much interest, from the fact that there is so much truth in his statements. I would like to add one or two instances to those already stated by him.

In regard to the economy of our steam engines and locomotives, Messrs. Sulzer Brothers, of Winterthur, Switzerland, build and erect engines, and guarantee to develop a horse-power with 12 pounds of steam (water) per indicated horse-power, and I may also mention the firm of Farcot et ses Fils, of St. Ouen, France, whose engines produce a horse-power with a consumption of one pound and a half of coal per hour in what is essentially a Corliss engine.

Then again let us take the locomotives of the Great Northern Railway of England with eight feet single driving wheels and domeless boilers, containing 1,045 square feet of heating surface and 18 square feet grate. These locomotives haul trains of 250 tons at the rate of 52 miles an hour, and consume only 26 pounds of coal per train mile. The Midland Railway locomotives with 88-inch diameter single driver; boilers with a heating surface of 1,240 square feet and 20 square feet of grate, haul 240 tons at the rate of 51 miles an hour, and consumes only 26 pounds of coal per train mile. The most economical locomotive in this country, on the Pennsylvania Railroad, hauling the same load, consumes 52 pounds per train mile, averaging about 49 miles per hour. This locomotive has 78 inch driving wheels coupled, 1,205 square feet of heating surface and 35 square feet of grate surface. The grades of the respective roads referred to are about the same; in fact, in favor of the latter. Why is this thus?

WM. BARNET LE VAN.

Pitting in Boilers.

Editor American Machinist:

In your issue of April 7, Question and Answer columns, those who ask Questions Nos. 148 and 149 seem to be suffering from nearly the same troubles.

I have had a similar trouble, and will give them the benefit of my experience with pitting. In our plant the engines are condensing with jet condensers, the boiler feed pumps taking their supply from the hot wells, and of course, getting more or less of the cylinder oil. I found with one kind of cylinder oil the tubes began to show a decided tendency to pit, and had to remove one. I then commenced to investigate for a cause. The water upon analysis was pronounced the best possible for steam boilers. Then I began trying different cylinder oils, and finally found one with which the pitting ceased and all was lovely for a time. But soon the joints in the steam pipes commenced to leak oil, and in the engines we have there are several flange joints between lubricator and cylinder, and all covered with cement covering. It meant no small job to remove covering, re-pack joints and get covering back in place; and, with the idea that we might do better, we again began our experiments and found an oil seemingly as good as the last that did not have so injurious an effect on the packing. Again we were happy, but after a time the flues begin to show the old signs of pitting, so we are placed in the position of "pay your money and take your choice." New flues, and possibly new boilers or new joints all around. I would like to have the opinion of someone who has had experience with joints leaking oil, as to the best way to pack a flange joint in pipe, with material to use.

"J.

Prefers to Pay for Catalogues.

Editor American Machinist:

I am somewhat interested in the discussion of the question of "Sending Catalogues" on the side of the party sending for them. I sometimes send for catalogues with a remote prospect of sending an order, and frequently propose to pay for them. At other times I obtain them from different manufacturers in the same lines, so as to make as good a selection as I can, solely in the interest of my clients, only one party getting the order. In all cases where I consider a catalogue worth sending for, I would prefer to pay a fair price for it, as I then feel under no special obligations to any party to select their goods. I consider a good assortment of catalogues about as valuable a part of an engineer's library as any books usually published, when kept in such a manner as to be easily referred to. Of course, like most other men, I am liable to errors in judgment, but to the best of my ability I always endeavor to select the best machinery or tools for which my clients are able or willing to pay. WM. J. SILVER.

Lapping—A Wood Turner's Lathe.

Editor American Machinist:

As one of your many readers I am favorably impressed with your editorial in the last issue, viz., "Do you read your trade journal?" For nearly ten years I have carefully read each article which has appeared in your valuable paper, and have invariably watched the advertisements therein.

The above statement may appear commonplace, but when I am known as a carpenter, and so called here, I think possibly I am an exception to your general class of readers. However, as my occupation is not confined exclusively to working in wood, and I am called upon to perform jobs in brass and iron, it is many times from the AMERICAN MACHINIST that I gain valuable assistance.

There is one word or process occasionally used by some of your writers that I venture is but little understood by many machinists who spent many years at the trade, and that is "lapping," or what a lap is, and how used. Again, I would like to know something about constructing head-stock for light wood lathe, say with three steps of cone to run at highest speed—4,000 revolutions. Lathe should be for small work 16" swing. You may say any good machinist can build one, but it is the experience of many that a good running wood lathe is a scarce article. I have two; one entirely new, recommended by the dealer to be good enough for anybody, and sent on trial. It answers a certain purpose, but falls far short of being what the builder intended it to be. I have known men, expert turners, who rarely find a satisfactory running lathe. The highest priced ones are not exempt from the fault of trembling, and though any first-class maker is willing to guarantee satisfaction, it has been so long since I have used one that meets my desire, it would indeed be a treat to use an acceptable one.

E. D. RICH.

[We think the term "lapping" is pretty generally understood among machinists. Anything is usually called a lap which is of a form which it is desired to produce on the work, and charged with grinding material over which the work is rubbed by hand, or, the lap may be driven by power. For instance, a cylinder of lead charged with emery and oil may be used as a lap, and upon being revolved in a lathe can be used to grind out a hole in a piece of hardened steel. Or the lap may be in the form of journal boxes which are held in a frame, permitting their being adjusted so that they will grind a cylindrical piece of work very smooth and to a uniform diameter. Laps may also be simple flat disks which are revolved by power; these, being charged with oil or water and grinding material suited to the work to be done, are used for producing flat surfaces upon work which may or may not have been hardened. Jewelers and lapidaries use them for finishing precious stones, and they are also used in finishing optical work. Laps occupy a very important place in mechanics, and their use should be understood by every mechanic. As to the lathe difficulty, we can only say that this seems to be simply a matter of balance. There can be little doubt, we think, that if a lathe spindle is absolutely true and in balance it will run steadily without trembling. The pulley should be of iron turned true inside and out, and care should be taken that the pulley is true, not merely when it is on the arbor in the lathe where it is turned, but after it is keyed or otherwise fastened to the spindle.—ED]

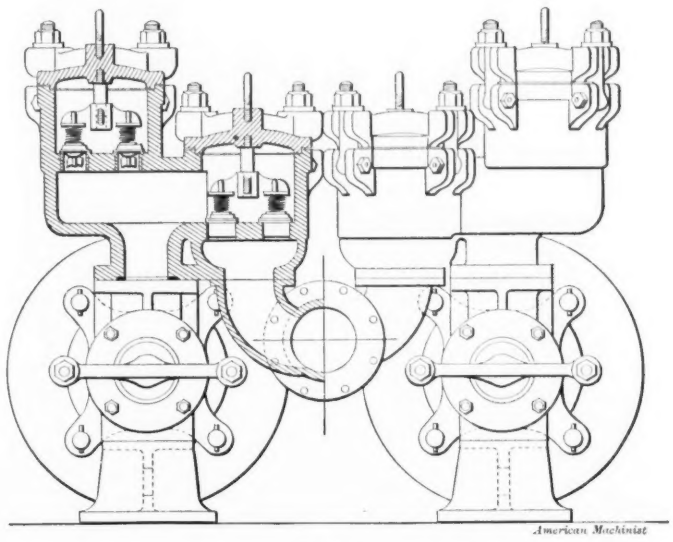


Fig. 3.

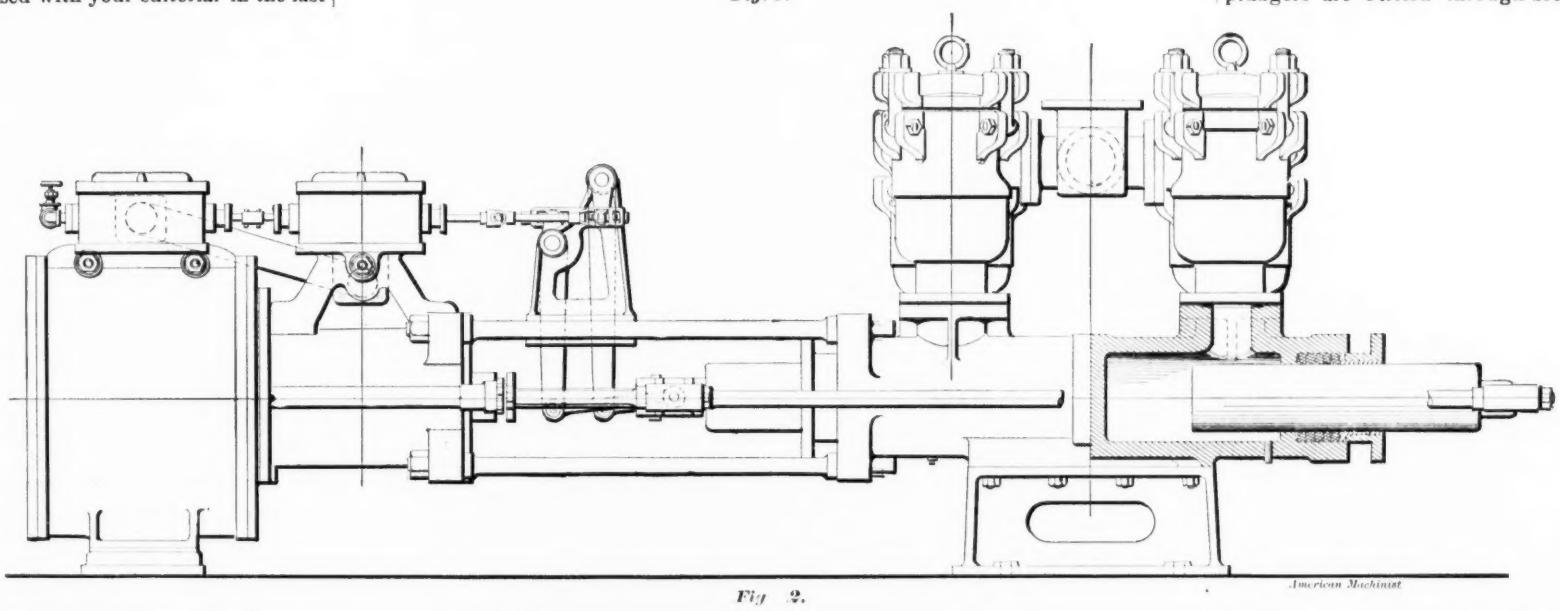


Fig. 2.

New Compound Condensing Mine Pump —Boiler Feed Pump.

The Buffalo Steam Pump Co., of Buffalo, N. Y., have made important improvements in their many designs of steam pumps, suitable for all kinds of service. With this we give illustrations of one of their latest compound condensing mine pumps; and a boiler feed pump.

Fig. 1 gives a perspective view; Fig. 2, a side elevation; and Fig. 3 an end elevation in section of a compound condensing mine pump, one of three recently built for station work. These pumps were built for service on the Gogebic and Minnesota Iron ranges. The high-pressure steam cylinders of the pump here shown are 12 inches diameter; low-pressure cylinders, 22 inches diameter; stroke, 18 inches; the plungers are 7 inches diameter. The rated capacity is 300 to 350 gallons per minute, delivered 600 feet above the station with a steam pressure of 65 pounds in the initial steam chest. The plungers are tied together with steel tie-rods coupled into cast-steel crossheads. The plungers are carried through bronze-lined stuffing box glands. The water passages are 50 per cent. of the plunger area. Each valve chamber contains three valves of a size that also equals 50 per cent. of the plunger area; both suction and discharge valves are overhead, so that the plungers are always water packed. The caps of the valve chambers are held by swing bolts. The pump is supplied through a 7-inch suction pipe, and the discharge is driven through a 6-inch column. This pump was furnished with an improved single air-pump and condenser designed for the most severe duty. The valves of the steam cylinder are of the ordinary plain slide type, and arranged to run by the ordinary duplex movement.

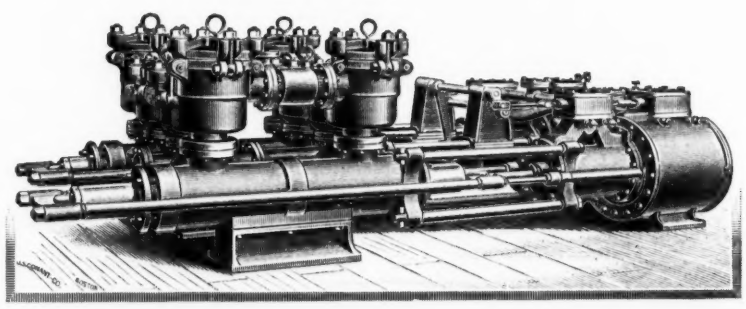


FIG. 1.—MINE PUMP.

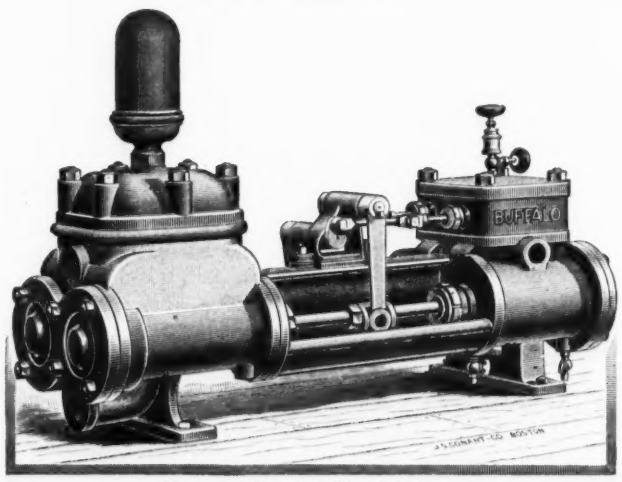


FIG. 4.—BOILER FEED PUMP.

Another pump has been built on the same plan. The high-pressure cylinders are 16 inches in diameter; low pressure cylinders, 30 inches diameter; stroke, 18 inches; diameter of plungers, 9 inches. The rated capacity of this pump is 500 gallons per minute, discharged at a height of 500 feet.

These pumps are well designed, as the illustrations show; due attention has been given to strength, simplicity and accessibility, so that the pump can be kept constantly in active service with a minimum amount of labor and care.

Fig. 4 shows a perspective view of a new design of a duplex boiler feed pump recently brought out by the same company. They are fitted with end suction and discharge pipes; and built to work against a pressure of 250 pounds. The water cylinders are fitted with removable brass linings. There are seven sizes of these pumps built, ranging from 3½x2x3 to 7½x5x8 inches. All the parts are made to templates and gauges and are interchangeable, so that any part can be quickly replaced should necessity demand it. The New York office of the Buffalo Steam Pump Co. is at 76 John street

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NEW YORK, MAY 5, 1892.

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Balancing Marine Engines.

The matter of balancing marine engines is now, we think, one of the most important problems that confront the marine engineer.

Though the piston speed which has been reached by marine engines is high, it is by no means as high usually as that regularly employed in fast-running locomotives with entire satisfaction, and lack of perfect balance seems now to be the chief obstacle to higher speeds.

This being true, the importance of a paper recently read before the Institution of Naval Architects, by Mr. A. F. Yarrow, becomes apparent, for he seems to have shown a way to materially increase speed, by a system of balancing. Mr. Yarrow's paper is published in *Engineering*, of the 8th inst. He had first made a systematic study of vibration of steam craft and of its causes; his conclusions being that vibration was not caused usually by the screw, he having removed the propellers from the shafts in some instances, and by an instrument which he devised, proved that the vibration was just the same with the engines running at the same speed, whether the screw was on the shaft or not. Where a change of screws had resulted in improvement in respect to vibration he attributed this improvement mainly to a change of speed of the engines which had resulted from the change of screw. Again, where it had been thought that vessels vibrated excessively because of structural weakness of the hull, and additional bracing had resulted in improvement, he believed the improvement due not to additional strength, but to additional weight; the effect of either a change of speed of the engine or of a change of weight of the hull being to prevent the hull from vibrating in a period identical or synchronous with the revolutions of the engine. He believed it possible to so proportion the weight and length of a hull to the revolutions of the engine as to avoid vibration by making them non-synchronous, but a better way seemed to be to so balance the engine that it would have no tendency to produce vibrations at any speed.

By calculations and experiments he had shown that this could be done perfectly, by arranging what he called "bob-weights," which were given a vertical reciprocating motion by means of eccentrics on the crank-shaft, these weights moving upward when the pistons moved downward, and *vice versa*. In the case of a single cylinder engine or of a tandem compound, where the bob-weights can be placed at each side of the cylinder and can have the same movement as the piston and other reciprocating parts of the engine, the two weights are made each equal to half the weight of the reciprocating parts of the engine. Where one weight must be farther from the cylinder than the other it is made proportionately lighter, the two weights being still made together equal in weight to the reciprocating parts of the engine. Where the stroke of the bob-weights is to be less than that of the piston they must be proportionately increased in weight, while if they have a greater stroke they may be lighter. A certain proportion of the weight of the connecting rod, depending upon its weight and the lateral motion of its center of gravity, was balanced by a rotary weight attached to the crank, the weight of the remainder of the rod being added to the bob weights.

For triple cylinder engines only two bob-weights were found to be necessary, these being placed forward and at the rear of the engine. In making the calculations for these, each set of reciprocating parts was first considered separately, and the weights necessary to balance it determined, supposing these weights to be attached to uniform disks attached to the crank-shaft. The amount and position of all these weights being determined, and supposing these disks so weighted to be attached to the shaft, the engine would be balanced vertically but not horizontally, and it would be the same if these several weights were removed and a single weight equal to the sum of all the others, and having the same position of its center of gravity, were substituted for them. This weight, when made to reciprocate instead of rotate, balanced the engine perfectly, as numerous experiments conclusively showed. The calculations necessary to get good results are simple, as will be perceived, but the author pointed out that it was very necessary that they should be based upon accurate data, calculations of the weights of the parts made from drawings not being sufficiently exact—the finished parts must be weighed.

There are many fast steamers in which vibration is so excessive as to make this one of the most unpleasant, if not the most unpleasant feature of a voyage in them, and besides, it is undoubtedly true that excessive vibration increases the wear and tear upon a vessel. There are some screw ferryboats running in New York harbor that would be greatly improved by such balancing, and it is to be hoped that Mr. Yarrow's system will soon be applied to all screw boats.

Decisions Which Do Not Decide.

It often happens that a good lawyer is required to decide just what a decision of a court really means and what its consequences will be to the parties in interest. To this fact is to be attributed many of the misleading items published regarding court decisions. But, on the other hand, many of such items are the result of pure carelessness, and as such carelessness sometimes results in positive and entirely undeserved injury to manufacturers who are interested, especially in suits for infringement, it seems appropriate for us to say a few words on the subject, and to define our position in regard to the publication of such matters.

We cannot do this better perhaps than by referring to a case which recently occurred, and wherein a number of our contemporaries, in their haste to publish what they considered an interesting item, and possibly to meet the wish of an advertiser, announced on their own responsibility that a certain manufacturer had gained an important victory over a competitor in a suit for infringement, the legitimate inference to be drawn from these publications being that the parties against whom the decision had gone would be obliged to go out of business entirely—a view of the matter which is very far from being sustained by the text of the decision, which shows that it is comparatively unimportant. The publication of these misleading items resulted in this instance from the publication of a circular by the winner of the suit, in which statements were made that, while justified to some extent by custom in such matters perhaps, were, to say the least of it, not judicial nor unbiased, and, taken by themselves, were well calculated to lead to a different conclusion from that which would be arrived at from reading the decision itself, or even that part of it which was published in the circular referred to, but which few editors, we suppose, would feel like taking the time to read with any care. The result is that some of them are being asked to retract and explain.

The fact is that no suit for infringement is finally settled until it has been decided by the highest court, or until one of the litigants abandons the contest and declares that he will go no further with it. Many of the decisions, therefore, which really do involve important matters do not at all decide the matter finally, because both parties are well aware that the case is to be carried higher for final decision. Of course, the party who wins such a suit in a lower court is justified in announcing the fact, even though he knows that the matter is not finally settled; but that does not, we think, justify a technical journal in publishing the news in such a way as to injure one side or the other, or cause disturbance among the users of the device in question. Usually there comes a time in all such contests when their final result can be known; then there is no injustice in publishing it, and, in fact, the ends of justice may be served by such publication. But it cannot be expected that parties to a suit will make unbiased statements regarding it; in fact, experience shows that some of them will make statements which are very much colored by their interests in the matter. It is natural that this should be so, but it is not to the best interest of any one concerned that this bias should influence the tone of comments or announcements published in journals supposed to be impartial, and to be concerned only with the exact and really significant truth of the matter.

Economy or Meanness.

We have before this alluded to the fact that the Navy Department had instituted some reforms bringing the methods more nearly in accord with the best practice in private establishments devoted to the same lines of work. These reforms have resulted in greatly increased efficiency, and there is no doubt whatever that the government is saving thousands of dollars annually by them.

We note the inauguration of a reform in the method of paying off employes, however, which, we think, carries the matter of economy a little further than looks well for such a nation as this. It seems that there had been the usual amount of red tape attending the operation of paying off, two men being required to witness the paying, and there were other features, making the process a complicated and tedious one. Now it is ordered that the paying operation shall not only be divested of its grotesque features, but that the paying is to be done out of working hours, so that the men and not the government shall lose the time that is still necessarily required. This, it is announced, is in imitation of private concerns, but we can mention many of the best managed private concerns in which the men are paid off in working hours, the several foremen, or some one especially detailed for that duty, handing each man his envelope in his place, and while at his work. Such a method of paying does not, as we know, result in any serious loss of time to any one, whereas, when paying is done after working hours, some of the men are usually delayed considerably.

We have never heard of an instance where office employes were paid outside of office hours in order to save their time to the employer, and we cannot see why shop men should be treated differently from office men in this respect. It is well enough and proper for the U. S. Government to practice economical methods, but we do not think it should descend to meanness in its treatment of employed citizens.

The English Miners.

A very significant thing in connection with the recent disturbance among the men in the coal mines of England is the fact that many of the miners are declaring that they know the operators' margins have been reduced below what they ought to be, but that wages certainly have been reduced to the lowest possible figure, and that it is the mine owners, who pocket their exorbitant mining royalties, that are oppressing both the operators and the miners. The latter declare that for their part they propose to remedy this state of affairs as soon as possible by political methods, and that if the operators do not join in the effort to remedy it they must look out for themselves. The miners point to the fact that in many instances the owners of mines—men who, neither themselves nor their ancestors for generations back have ever done a stroke of useful work of any kind—get in royalties more per ton than the miners get for mining the coal, and thus they have the spectacle of such men receiving a gross income from a mine, largely exceeding the combined gross income of the mining community which was doing the work. Of course, whatever is burdensome to miners and mine operators in England is burdensome to her industries generally, and when harmonious action can be secured by employers and employed, looking to the common defense against oppression, the way will be cleared for some reforms which now seem far off. We believe there are many instances in this as well as in other countries where employ-

ers and employes, who each believe the other is oppressive and unreasonable, would find by opening their eyes a little that the real oppression comes from the outside, and could be lessened by intelligent and concerted action.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(184) H. G., New Castle, Pa., asks: Is there a school of any kind where pattern making in all its branches is taught? *A.*—So far as we know there is no such school.

(185) W. H., ——, asks: How are lawn mowers so truly ground at the factories? I should like to know, so that I can do it myself. Filing will not do, for that makes the edge of the knives uneven. *A.*—They are ground in the same manner as milling cutters are ground, *i. e.*, the shaft upon which the knives are mounted is supported either upon centers or in suitable bearings, adapted to slide along endwise in front of an emery wheel. In front of this emery wheel is fixed a small rest upon which the edge being ground rests and slides, the same as in grinding milling cutters.

(186) C. S., Philadelphia, Pa., writes: Please give me a method for laying out a cone to get the curves in making a funnel of sheet metal. *A.*—See our issue of December 19, 1889, page 4. 2. Please give me a rule for finding the flow in a given size of pipe from a tank at any given height. *A.*—See answer to Question 21, in our issue of January 14, current volume.

(187) Reader, ——, asks: What is the name of a square thread cut on a shaft which returns on itself, crossing from right to left without ending, usually employed where a slow shifting motion is desired? *A.*—We do not know that there is any generally recognized designation for such a thread, but it is sometimes and may be properly called a "crossed thread."

(188) J. F., ——, asks: Can a pulley be properly balanced upon an arbor that is $\frac{3}{32}$" smaller than the bore of the pulley? *A.*—We have never tried to balance a pulley upon such an arbor, nor have we known of others trying it. It might be done possibly, but we should think that even if accomplished, it would be tedious and expensive compared with the usual method by a properly fitted arbor.

(189) M. A., Torino, Italy, asks: What is the best and most practicable angle to make the teeth of spiral spur gears which are run together on shafts which are parallel, the proportion of the gears being 1 to 3? *A.*—We do not know that we can say what the best angle should be in such a case. The only object in making the teeth spiral is to secure smoother running than would otherwise be the case, and the angle is usually made such that one pair of teeth retain their contact at one side of the gear until the next pair are in contact at the other side.

(190) D. B., ——, asks: What would be the end thrust on the foot-stock of a lathe with a parallel shaft weighing 2,700 pounds, resting on the centers which are the standard 60° angle? Is this right, making no allowance for friction: $\frac{2,700 \times .5}{.866} = 1,558 \div 2 = 779$ pounds on one center, taking the sine and cosine of 30° as the height and base of a triangle, as it bears on the top of the center only? *A.*—Your method brings the correct result, but it might be arrived at a little more directly by saying that the end thrust would be as the tangent of the angle of 30°; then taking half the weight of the shaft, 1,350 pounds, and multiplying this by the tangent of 30°, .5774, we get 779.49 pounds.

(191) G. E., ——, writes: I am apprenticed in a large machine shop, to serve five years. I am going to be a lathe hand. My friends say I ought to learn vise work also. Do you think I am right in learning one branch only? Also if I can get employment easy as a lathe hand? *A.*—We do not think you are pursuing the right course. Five years' apprenticeship should be plenty long enough to give you a good insight into the machine trade generally, and if you have any natural ability whatever it is simply absurd for you to serve five years' time in learning to do lathe work. You cannot get work as easily if you are only a lathe hand as if you were an all-round machinist, capable of doing a good job at anything that came to hand.

(192) Veritas, Philadelphia, Pa., writes: I have a compound non-condensing engine with the following data. I will be obliged to you if you will show me how to obtain the initial and terminal pressure of the low-pressure cylinder; also the horse-power of each cylinder; steam pressure is 100 pounds, diameter of high-pressure cylinder, 12 inches; diameter of low-pressure cylinder, 20 inches; stroke, 14 inches; revolutions per minute, 250; cut-off at ¼ stroke in both cylinders; the high-pressure cylinder exhausts directly into the low-pressure cylinder. *A.*—The rules for finding the initial and terminal pressure in the large cylinder of a compound engine, and the horse-power which the steam will develop in each cylinder, are given in the articles treating on compound engines, by J. Tribe. Examples are worked out, the whole subject is thoroughly explained, and after a careful study of these articles you should have no difficulty of applying the rules to any compound engine. See our issues of August 20, 27, and September 10, 1891.

(193) F. K. A., ——, writes: Please give a rule for cutting triple threads on the lathe, if there is any. *A.*—The most practicable way usually is to select a gear for the stud which is divisible by three, and when one thread is cut mark this gear and the intermediate, let the lathe stand with the nut closed and all lost motion taken up, slip out the intermediate, turn the lathe until the gear has made one-third of a revolution, and slip the intermediate into place again. This, of course, is where the stud runs at the same speed as the lathe spindle; where it runs half as fast the gear must make two thirds of a revolution before restoring the intermediate to its place. The same procedure is followed with the third thread. The same thing may be accomplished by turning the gear on the screw, and thus advancing or retarding the carriage by an amount equal to the pitch of the thread. For instance, suppose the pitch of the spiral to be one inch. The pitch of the threads—*i. e.*, the distance from the center of one thread to the center of the next—will be one third of this, and so one-third of an inch will be the distance to move the carriage after cutting each thread. Suppose the lead screw to have four threads per inch, it will therefore be necessary to turn the lead screw ¾, or 1½ revolutions.

(194) H. H., ——, writes: A. has a horizontal hydraulic cylinder with one piston, and admits water under pressure at one end of the cylinder. B. has the same size cylinder and the same pressure, but has two pistons, admitting the pressure in the center of the cylinder, and forcing the pistons towards the ends. B. claims that he can develop twice the power with his arrangement that A. can develop with his, while A denies this. Who is right? *A.*—If the water is admitted to the cylinders in each case, so that the pressure is maintained during the movement of the pistons, or so that the average pressure throughout the stroke is the same in all cases, and if each of B.'s two pistons move at the same rate as A.'s one cylineer, the power developed by B.'s arrangement will double that developed by A.'s. These conditions can be obtained in practice. 2. What is the advantage, if any, of transmitting power by ropes? *A.*—Generally speaking, it is doubtful if there is any advantage, except in cases where gears or belts would be inadmissible, and in England, where rope driving has been largely used as a substitute for gears, they are returning to gears, using cut gears instead of cast gears, as formerly. We have already published a rule for designing the grooves, and it will be found in our issue of July 21, 1888.

(195) M. S., Grenchen, Switzerland, asks: What is generally considered the best lubricant for 1½" shafting running 230 revolutions per minute—oil or paste? *A.*—We think that oil is generally considered to be best for such a shaft. 2. What experience has there been with self oiling hangers in the U. S? Do they really need refilling but once in four months, as some manufacturers claim? *A.*—Self oiling hangers are extensively used in this country, and are generally found to be satisfactory. In some cases we think there is no doubt that they will run four months without refilling. 3. How is the oil conducted to the shaft? *A.*—There are various methods of doing this. Some do it by wicking or other fibrous material, which rests in an oil reservoir below, and comes into contact with the shaft at certain points near or at the top of the bearing. Others use a small chain, which conveys the oil. Many engineers, however, prefer a box of the ordinary type provided with a self-feeding oil cup applied at the top of the box, and in addition to this, such boxes are sometimes provided with an open cup at each end, in which is placed tallow and oil of such a consistency that it will melt and run into the box if its temperature rises above the ordinary summer temperature of the air.

(196) J. W. B., ——, sends us a sketch of a train of spur gearing, which includes four driving gears, four driven gears, a drum over which a chain is wound to raise 60,000 pounds weight, and a pulley on which is placed a double belt. The pitch diameters of all the gears are marked on the sketch, but we disregard this, because he states that the first driving pinion runs 150 revolutions and the drum 3, thus giving us the ratio of the train at once. He says he had a 36"x6" pulley with a double belt driving this train, but did not get sufficient power, and he now proposes to put on a 48"x9" pulley, and he asks: Will this give me enough power? *A.*—The ratio of the train is 1 to 50, so that if the pulley were the same size as the drum its surface would move 50 times as fast as the drum, and therefore the force required to just move it, disregarding friction, would be $\frac{1}{50}$ of 60,000 pounds, which is 1 200 pounds. The pulley which it is proposed to put on is 48" diameter, and therefore the force required to move it will be less. The drum is 28.5" diameter, and with a 48" pulley the force required to be applied to the rim of the pulley, in order to just establish equilibrium, will be 48 : 1,200 : : 28.5 : 712.5 pounds. With a 9" belt the strain per inch of width will be $\frac{712.5}{9}$, or 79 pounds. In such a train we should add 40 per cent. for friction, which would give 110.6 pounds per inch of width, which is more than the belt should be required to do. We should therefore use a 15" double belt, thus reducing the strain in the working side of the belt to about 66 pounds per inch plus the strain on the slack side. Another method would be to consider that the 60,000 pounds raised at 3 revolutions of the drum per minute would require 40.7 horse-power. Adding to this 40 per cent. for friction, the belt would have to transmit 56.98 horse power. Now employing the formula

$$W = \frac{H \times 1,925}{D \times R},$$

in which W = the width of double belt required, H the horse power, D the diameter of the pulley in inches, and R the number of revolutions per minute, we have, substituting the proper figures for the case in hand,

$$W = \frac{56.98 \times 1,925}{48 \times 150} = 15.2" +$$

for the width of belt required.

(197) A. Q., Worcester, Mass., writes: I have sent you by express a small package containing samples of steel plated stock, of which I give you a description, and I desire, and would be greatly benefited by an explanation in your Question and Answer columns as to cause of the imperfections. The stock is made in pieces 70 inches long which have a twist in them, one turn in 70 inches. The stock is made by welding and rolling; a very high grade of improved steel is used. The stock is cut or split in two, and makes two pieces, each of which is heated and fitted to a given circle, then ground on each side just enough to take off all the scale formed in working the stock. The pieces are then twisted cold by running them through two sets of rolls. The first set is stationary; the second set is made to change to any angle desired, so as to get more or less twist. The pieces are then heated in an oven, or brick furnace, where the heat is evenly distributed; then hardened to what they call a "glass hard," so that they cannot be touched with a file. Before the stock is cold it is run through the rolls again, so as to be sure the twist is right. After this, the pieces are sent to the shop, and are polished on wooden wheels 12 inches in diameter, and covered with No. 70 or No. 90 emery; the surface speed is about 4,000 feet per minute. We go over the stock four times on each side, and not until they are nearly finished can we see any defects. There are three forms of defect. First, you will find the steel cracked; second, where the steel joins the iron you will find cracks or scratches, sometimes on the top of the steel, and extending to the same distance on the iron; third, the pieces are covered with spots, and will sometimes break at these spots. The foreman claims that all these defects are caused by polishing, and the firm by whom I am employed agree with him. I claim that the defects 1 and 2 are caused by twisting when the stock is not in the right condition, or too cool. The third I cannot explain, but I have my opinion, and believe that none of the defects are caused by polishing, although we have to warm the stock somewhat in polishing. If you will kindly give me your best judgment in regard to the trouble I will be greatly obliged, and it will help me very much. *A.*—The first defect to which you refer we believe to be due to twisting the stock without heating it. The second defect we believe to be due to some hard foreign substance on the wheel; the stock is evidently scratched, and this is done during the polishing process. The third defect is due to flaws in the material.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

See Gage advertisement below.

Armstrong Tool Holder. Armst'g Bros., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Gage Tool Co.'s Self-setting Plane does more and better work in less time. On trial. Vineland, N. J.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

25" | 32" | 37" | 42" | "Only Drill Press built on 'Ko-rekt' principles. Even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Complete treatise on Screws and Screw-making, with clear and consise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt St., N. Y.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic should miss. The cheapest work ever issued. 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Binders" for the AMERICAN MACHINIST. Two styles: the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Just Published: Safety Valves; their History, Invention and Calculation, including the most recent examples of Weighted and Spring loaded Valves, also showing the effect of Atmospheric Pressure on Safety Valve Disks; showing the curious phenomenon of balls being sustained by an inclined current of air, Vacuum Valves, etc., etc., by William B. LeVan. Fully illustrated, pocket-book form. $2. Our Book Catalogue sent free. Norman W. Henley & Co., 150 Nassau Street, N. Y.

Pattern Making.

BY P. S. DINGEY.

PLUG VALVES.

III.

There have been so many improvements made in valves in recent years, that the ordinary plug valve is becoming almost a thing of the past. One of the reasons why many engineers have discarded the old forms, is the liability of the plug or tumbler to fasten itself so tightly in the shell as to make it hard to turn. The cause for this "sticking fast," as it is generally termed, is not always the one so often given, viz., corrosion, but is rather the unequal expansion of the plug and shell, sometimes due to the bad proportioning of metal in the two parts, and by making the shell of cast-iron and the plug of journal metal. The making of these two parts from different metals may prevent corrosion, but it rather increases the tendency to unequal expansion.

Fig. 9 is a section of a form of plug valve known in England as the "Etchell Tap," and is used mostly as a blow-off valve. The advantage claimed for this design over the old style is that it will not stick fast in its seat. The plug being inverted, a better distribution of metal is obtained, permitting the steam or hot water to circulate all around the inner parts of the valve, distributing the heat, by which means unequal expansion is obviated to a very large extent.

It is not intended under the above heading to discuss the merits of valves, so much as to show the manner of constructing the patterns and core boxes; yet these few general remarks will not be out of place.

The pattern for the body of the valve is parted through the same plane as that of the section. Fig. 10 represents half of the pattern of the shell or body without the bonnet and stuffing box. The ball part of this shell, and the two core prints, are turned between its two centers *A B*, while the inlet piece is turned separately and fastened to the ball part, the latter being cut off flat to dotted lines for that purpose.

For large valves it is advisable to build up this pattern hollow, of segments, instead of making it solid, as shown, because a large solid block will shrink and crack, in which case it generally becomes necessary to plane off the joint of the pattern, to make the halves fit closely together again, as they should.

By referring to the section in Fig. 9, it will be seen that two core boxes are needed for the shell, one for coring the space inside the conical part, and the other for the outside. Let these two spaces be designated *C* and *D*. The core box for the space *D* is shown in Fig. 11, and as two half cores made from this box would not match each other if pasted together, the box is arranged so that the cone *E* can be taken out and located at *F*, by which means half cores can be made that will match each other when put together; *a b* is a core print let in flush with *E*—before rolling the core over on a plate, the cone *E* is drawn out and the space filled with green sand.

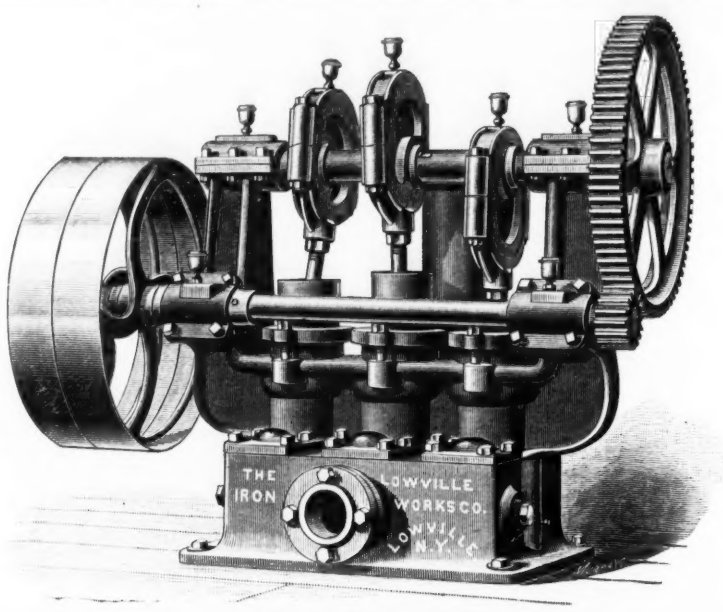
Fig. 12 is a core box for the space *C* in Fig. 9, and is pasted in the main core *D* at *a b*, when dry. The view to the left represents the side view of this box.

Fig. 13 is a pattern of the tumbler or valve, as seen in the section in Fig. 9. This pattern is intended to be molded on end, with square part *G* down. The core, which is shown by dotted lines, is carried by the two core prints marked *c d*. Notice that these two prints, of which *f* is an end view, are carried nearly to the end of the pattern. This, of course, is necessary for the sake of molding, and for dropping in the core; but provision is made in the box at *x x*, Fig. 14, by which this part of the print is filled in by the core, so that the molder is saved the trouble of building over the core.

It is unnecessary to show here the way of making the patterns for the stuffing box and gland seen in section in Fig. 9, as they are so easily made that it would be uninteresting to ordinary pattern makers.

In most points we consider ourselves as a nation much farther advanced in civilization than Turkey; but we notice that the Turkish government has recently issued an order prohibiting the importation of patent medicines. We do not, of course, think that that nation is most civilized that does most to prescribe what its citizens shall eat, drink or take as medicine; but if public sentiment in Turkey approves of the exclusion of patent medicines, we should say that there are some things at least which we might learn from Turkey—we, a nation of people who largely overwork and otherwise mistreat ourselves, and then let our imaginations decide what the trouble is, and what the remedy.

It is said that the Pennsylvania Railroad Company will spend $5,000,000 on the road west of Pittsburgh before the opening of the World's Fair; this does not include rolling stock and motive power.



TRIPLEX POWER PUMP.

Power Pumps.

In our issue of April 28 we described the duplex and triplex pumps made by the Lowville Iron Works Co., Lowville, N. Y. By mistake no cut of the triplex pump was shown, two electrotypes of the duplex pump being used instead of one of each; hence we publish cut of triplex herewith.

Apprenticeship and Technical Education.

BY ISAAC WHITEHEAD.

The question of the best methods to "develop a good mechanic" is a vital one. We are all anxious to find its best solution, the parents for the boy, the boy for his future welfare, and the citizen for the country.

There is no doubt the apprenticeship system has passed its period of usefulness, and in most of the places where it still exists, it is a fraud upon the boy and the boy upon the trade as a machinist. In machine shops where the work is rough and simple, and there is the least possible to learn, we find the most apprentices, as it is a position where the employer can get the greatest return for the least time spent in instruction. Even here it is the exception rather than the rule that the boy gets the opportunity to learn to operate more than one or two machines. The idea is simply that they can be hired under the name of apprentice for less than as helper.

In my seven years' apprenticeship, the regulation period then in England, I judge that two years was spent in waiting upon the men, no knowledge gained except through the eye, while the rest of the time was a constant struggle of the employer to keep me on what I could do, while I wanted to learn by working upon something I could not do. It was a true saying among the men that a man learned more of his trade the first two years in other shops than in all his seven years' apprenticeship.

I am glad it is going out of practice, as it will be replaced by a far superior method in the technical and manual school training which is now commencing as a preparatory groundwork, from which any specialty of manufacture may be entered into with intelligence.

The majority of our machine tenders now are laborers that have been trained to that machine alone, and they are stereotyped in all their work; but take a man that has been taught the principles of mechanics, and he is able to grow and improve upon the mechanism and handling—such persons alone are the mechanics.

The principles of mechanism, which are applicable to all shops, can be taught in the schools, illustrated in drawings, and proved and developed in the laboratory sufficiently for their perfect understanding, so that it becomes not a question of memorizing, but actual knowledge. In many cities this training is forming a part of the studies of the public schools, so that a boy or girl on leaving the high school will be fitted to enter life's work in mechanics as well as in the professions towards which their education has been in the past more specially adapted.

I do not assume that the training possible in school or college can turn out practical mechanics, any more than lawyers and politicians, which is the nearest the old system reaches at present to practical work. It is a mistake to assume that this school training is for foremen and managers only, and that they can skip the workshop experience and begin at the top. This idea has brought upon the training some ridicule, but it should be considered as a preparatory groundwork for a thorough knowledge of any mechanical business, and that the specialty manufacture will call for further training, just, also, as any mechanic going from one production to another has much to learn before he is an expert in its production.

The union of the manual with the technical training is but the reflection of the universal desire of ambitious boys who wish to know the principle involved in the work they are doing. The good mechanics of today, and in fact of all time, have taken this course, virtually by self-instruction during its application. To the study in evening science classes during and subsequent to my apprenticeship I ascribe more of my success as a workman than to any other agency. We must not forget the fact that, though we speak of an apprenticeship stage, yet a good mechanic is always learning, and when I say that the school training is a preparatory work, so also all our lives we are laying that foundation for future excellence.

The first groundwork, therefore, should be laid in a systematic and careful manner, "order being the first law of nature."

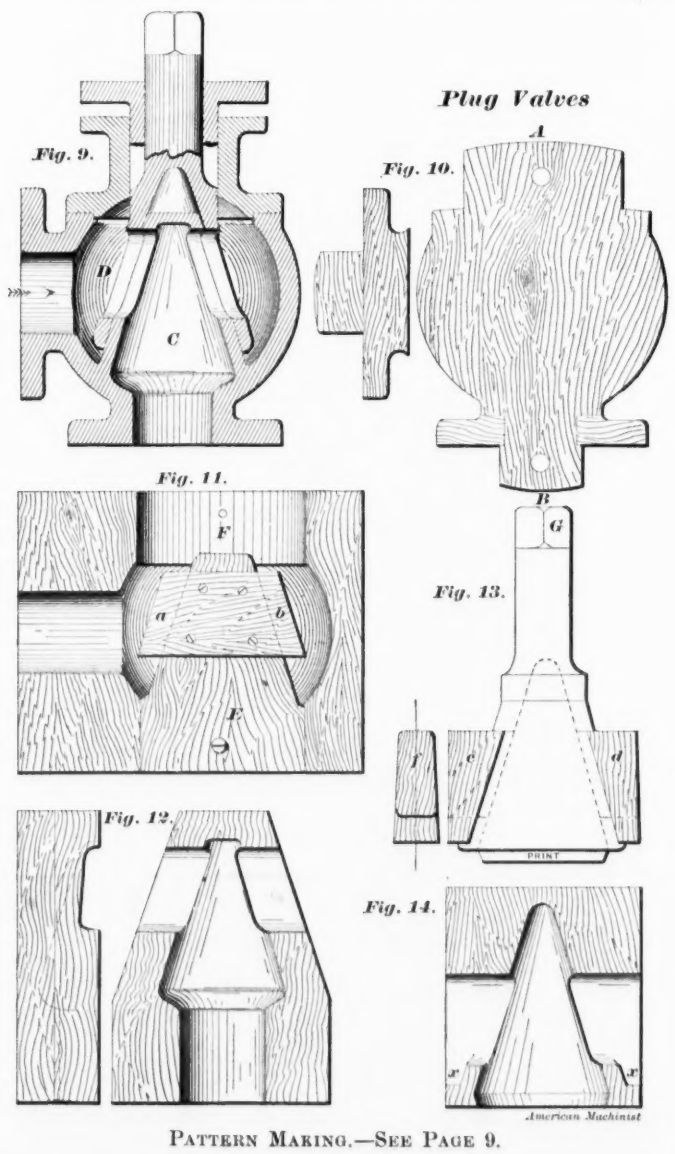
Now, this is not possible in the present state of competitive production, but in an ideal training we would arrange a series of progressive exercises, each exemplifying a principle of mechanics or operation.

This education is not one-sided, as in the case of specialties, but is aimed at the complete development of the mechanical faculties, which, when afterwards applied to a specialty, will be able to bring to bear a broader vision, and not like the machine-tending laborer, who, like his machine, must act always the same from imitation rather than reason.

The best solution of this question, therefore, is in the action of many of the public high schools in their adoption of manual training in connection with their science studies as the necessary laboratory to its full comprehension, in conjunction with the study of English, etc., thus fitting them better for the position in life they will be likely to be called to occupy.

If this course is generally adopted a much greater percentage of children will stay longer at school and get the benefit of the higher practical education; and socially the mechanic will stand upon a higher plane, more in keeping with his importance as a factor in this age of progress.

The officials—following the usual course in such cases—refused to make known the manner in which Engineer Gray was killed by the machinery of a ferryboat running between New York and Jersey City. A New York daily has found, however, by inter-



PATTERN MAKING.—SEE PAGE 9.

viewing the deck hands, that "it seems that from some cause, at present unknown, the engineer, Joseph Gray, fell into the slot in which the pistons of the engines work." This makes it clear, in spite of the uncommunicative officials.

MANUFACTURES

The Standard Machinery Company has been incorporated at Philadelphia, with a capital of $25,000, to manufacture knitting machines.

The Kootenay Powder Works Company, with $25,000 capital stock, has been incorporated, to manufacture explosives, at Nelson, B. C.

A portion of the tool equipment of the Grant Locomotive Works is being put in position. The works will be ready for operation about July 1.

Wm. J. Betterton, Samuel T Morgan and Charles L. Betterton have filed charter for the Dallas Smelting Co , of Dallas, Tex.; capital stock, $30,000.

Goddard Bros.' foundry, blacksmith and machine shops at Fremont, Wash., which were destroyed by fire on the 21st ult., will be immediately rebuilt.

A $20,000 stock company is bein formed, to manufacture the Dupont trip hammer, the Howard saw table and the Howard saw gummer, at St. Johnsbury, Vt.

The Northern Pacific Car Truck Co., of Chicago, Ill., has been incorporated, with capital stock of $2,000 000, by George E. Marden, Francis W. Parker and J. Elliott.

The Lloyd-Booth Co., of Youngstown, Ohio, has purchased the .Etna machine shop and foundry, at Warren, O., and ins.de of 30 days the works will be in full operation.

J. S. Murdoch, J. F. Ficken, A. T. Smythe and others have incorporated the Charleston (S. C.) Construction Co., to deal in machinery. The capital stock is $50,000.

E. L Deane, Holyoke, Mass., has issued a circular and price list of T-square with patent adjustment and swivel, made in hard rubber, wood, and transparent amber.

The Union Iron Works and Steam Heating Company has been incorporated at Ottumwa, Ia., with a capital of $60,000, and will conduct foundry, iron, brass and machine shops.

The Franklinton (N. C.) Cotton Product Co., recently incorporated, will erect a cottonseed-oil-mill and fertilizer factory this season, and later may erect a cotton factory.

The Flateau Manufacturing Company, of Dallas, Tex., recently incorporated, will manufacture malleable iron, doub e and single trees. John H. Trayler and others are the incorporators.

The new structural steel plant at Duluth, of which James E. York is general manager, is to be located at Ironton. A bonus of $125 000 has been raised. The output of the plant is estimated at 100 tons per day.

J. H. Horne & Sons Co., Lawrence, Mass., have decided to bu ld a new machine shop 64 feet wide by 107 feet long, and have placed the contract for the same with The Berlin Iron Bridge Co., of East Berlin, Conn.

There is water-works agitation in Asheville, N. C.; Holyoke, Mass.; McKeesport, Pa.; Dothen, Ala.; Walden, N. Y.; Portland, O.; West Milton, O.; Kenton, O.; Burke, N. Y ; West Liberty, Ia.; Preston, Ia.; Idinburg, Ind.; Welishire, O.

It is likely that Big Stone Gap, Va., will have more iron furnaces. President Bird, of the Appalachian Steel and Iron Co., is negotiating with Pennsylvania parties relative to the location of two more furnaces in that vicinity.

The Haberkorn Air-brake Co., at Fort Wayne, Ind., has been formed, for the purpose of manufacturing air-brakes. The capital stock is placed at $500,000. Theodore H. Haberkorn, Alfred D. Cressler and others are directors of the company.

The Williford & Northway Mfg. Company have commenced the erection of a plant at Jordan, Minn. The main structure will be 276x48 feet, two stories high, and the foundry will be 180x48 feet. Operations will begin June 1, with 125 hands.

The Central Railway Co., Baltimore, Md., has awarded contract for the erection of its power plant to the Thomson Houston Electric Co., of Boston, Mass. An improved switchboard and lightning arrester is to be included in the equipment.

In Westerly, R. I., the chief new enterprise undertaken since the passage of the McKinley act is a large thread-mill, which Robert Clark, of Newark, N. J., is mainly interested in. This mill will probably be in operation within four or five months.

The Wuerpel Switch and Signal Co., of East St. Louis, has been incorporated, for the manufacture of railway and mining appliances. The capital stock is placed at $100,000. The incorporators are Morris Wuerpel, Pierre Chouteau, Charles H. Huff, and Richard C Ludlow.

Shelby Steel Tube Company, Shelby, O., have recently increased their capital stock another $100,000. It is their intention to erect two more buildings, which will give a capacity of over 7,000,000 feet of tubing per annum. This will require additional machinery and the employment of some 300 or more hands.

Under the new and energetic management of R. E. Townsend, president, and H. L. Perrine as engineer of the Buffalo Steam Pump Co., Buffalo, N. Y., important improvements have been made in their line of steam pumps suitable for all kinds of service. At present the full capacity of their works is tasked to fill the orders promptly.

The Chicago Chemical Solution M'f'g. Co., 218 La Salle street, Chicago, Ill., issue a little pamphlet relating to the use of the Acme Chemical Solution for cleaning castings, scaling of plate iron and steel, cleaning iron for galvanizing, tinning, etc. It is claimed for the solution that it is much superior to acid, tumbling, etc., for the purposes.

The Chicago Foundry Supply Company, Eighteenth and Rockwell streets, Chicago, has increased its capital stock to $75,000. The additional capital was needed for the enlargement of the plant and the purchase of new and improved machinery to meet the heavy demand for the company's goods, such as foundry supplies and equipments.

The National Chuck Manufacturing Co., of Mount Vernon, N. Y., has purchased the plant and patterns of the former manufacturers of the "National" chuck, and a shop is being fitted with special tools for the manufacture of the "National" and a line of drill chucks. Wm. Whitlock is president and treasurer of the company, and Mr. Robert Rogers is secretary.

The Montague & Lea Machine Tool Co. has been incorporated under the laws of West Virginia, with an authorized capital of $100,000, by Wm. L. Montague, Edw. S. Lea and T. A. B. Dukehart, of Baltimore, and H. W. Hunter and J. G. Cook, of West Virginia. They will at once erect extensive machine shops and foundry at Moundsville, near Wheeling, W. Va. Montague & Lea, of Baltimore, can give information.

The Morton Manufacturing Co., who recently moved to new shops at Muskegon Heights, Mich., write us that business is going along very well with them. Several improvements have been made in their lightning key-way cutter, such as a new centering chuck, a setting attachment that does away with any other measuring in setting the machine, a binding attachment that avoids the use of bolts and nuts, etc. The company is bringing out new machines and preparing for a larger volume of business.

The Sullivan Machine Company, of Claremont, N. H., and the Diamond Prospecting Company, of Chicago, having been closely identified for a number of years, have formed a new company, the Sullivan Machinery Company, to carry on as one organization the business formerly done by the two companies. The capitalization has been increased $500,000, and a plant will be located in Illinois, on the line of the C., B. & Q., for the manufacture of heavy machinery and repair work.

The foundry of the Syracuse Steel Foundry Company, Syracuse, N Y., which was destroyed by fire January 7 last, has been rebuilt, and the last of the machinery is now being placed, preparatory to starting up. The company have also completed a second open-hearth furnace The plant consists of the following buildings: A machine shop 60x142 feet ground dimensions; a melting room and store house 85x192 feet; a molding room 74x133 feet; a core room, 20x70 feet; a separate boiler house, 49x65 feet; a pattern shop, 20x60 feet; an office building, 28x30 feet.

The Hoppes Manufacturing Co., Springfield, Ohio, write us: We have about completed the erection of a new factory upon an elegant site at the opposite end of the city, in which we now are. The main building, which is of brick with slate roof, is 60 feet wide by 176 feet long, with a wing for engine and boiler rooms. We expect to get moved on or before the 1st of May, and as we have greatly increased our room and facilities for manufacturing, we will be in a position to turn out, in addition to our purifiers and heaters, any and all classes of light sheet-iron and heavy plate work of all descriptions.

The Aerated Fuel Co.'s System was started last week at Coates & Co.'s new tin-plate-mills, Locust Point, Baltimore. It is used under two boilers in the plate rolling-mills, and also in the tinning furnaces. We are informed that everything went off successfully at the first lighting of the fires, and that Coates & Co. and others who have seen the plant are much pleased with its working. The plant was put in by Messrs J. C. Faulkner and Nelson Hoyt, experts in the employ of W. S. Collins, Licensee, 45 and 46 Drexel Building, New York. Mr. Collins is also in receipt of a letter from the ordnance department of the Navy Yard at Washington, in which the system as used in the hot air furnaces in the shrinkage pit is highly commended.

Machinists' Supplies and Iron.

NEW YORK, April 30, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2, $14.75 to $15; Grey Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2; and $13 to $13.50 for Grey Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is satisfactory.

We quote Haliett's, 10¾c. to 11c.; Cookson's, 14c. to 14½c.; and L. X., 12¾c. to 13c.

Copper—The market is rather firmer, without actual business. Car-loads are held at 11.95c. to 12⅛c., according to holder. Casting Copper is quoted at 11.15c. to 11.25c.

Lead—The market is stronger. 4.27½c. is bid, and 4.30c. asked for immediate delivery, but future business can be done at 4.27½c.

Lard Oil—The market is firm at 56c. to 57c. for Prime City. Western on spot is quoted at 55c. to 56c.

Spelter—Smelters have named 4.85c. by the carload for New York delivery, but consumers are not disposed to pay the advance.

Tin—The market continues to advance, in sympathy with higher prices abroad. Sales have been made at 20.65c. to 20.70c. The quotations are 20.70c. bid and 20 80c. asked.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—3 exp'd mech. draftsmen for about 3 months. Geo. D. Dutton, Springfie.d, Mass.

Mech. draftsman wants position in New York or vicinity; best references. Box 99, AM. MACHINIST.

Wanted—Employment; 16 years' exp. in mfg., sale and erection of machinery. "Practical," AM. MACH.

Experienced draftsman wants position at once. F., Box 138, Kendallville, Ind.

Position wanted by a draftsman with experience and education. Address "Tool," AM. MACHINIST.

Wanted—A first-class mech'l draftsman; state age, exp., and salary expected. Permanent position to the right man. Address Box 101, AM. MACH.

Wanted—A tool maker on punches and dies, one accust'd to watch factory work pref'd. National Optical Co., 11th and Mifflin Sts., Philadelphia, Pa.

Mechanical draftsman, familiar with modern shop practice, a designer of machine tools, and special machine tools and fixtures, desires a change. Address Box 103, AM MACHINIST.

Wanted—Position as foreman with concern m'f'g small interchangeable work; can design tools and labor-saving devices. "No Slouch," AM. MACH.

A young man who has worked in machine shop 2 years wants an opportunity to complete his apprenticeship in a good shop. Address Box 104, AMERICAN MACHINIST.

Wanted—A 1st-class man to run a Jones & Lamson 2x24 flat turret lathe. Address, giving past and present employers and amount of experience on this tool, Taunton Loco. Mfg. Co., Taunton, Mass.

Wanted – Machinist; a good vise hand and scraper, with experience in machine tool work; must be sober and steady. Address, with refs., The Henley Machine Tool Works, Richmond, Ind.

Position, by a mechanical engineer who has occupied position in two manufacturing companies during past 15 years as designer, superintendent, traveler and manager. Address W. N. S., AM. MACH.

Wanted—Pos. with firm making hoisting mach'y for electric, hydraulic, steam and hand power, by draftsman with large exp., tech. education, used to making calculations & estimates. Crane, AM. MACH.

Draftsman, graduate of Swedish college with 3 years' practice in drawing room in America, and several years in shop, wishes change of situation; steam engines preferred. Address Box 102, AMERICAN MACHINIST.

Wanted—By an expert in turret screw machine work, a position where tools designed to produce rapid and accurate work, correct estimates, and efficient shop management will be appreciated. Address W., care AMERICAN MACHINIST.

Wanted—Foreman of machine shop, in an engine works in the East, employing 200 to 300 hands. Must be familiar with interchangeable and jig work, piece work and other modern methods, and capable of handling men to advantage. Address Box 95, care AMERICAN MACHINIST.

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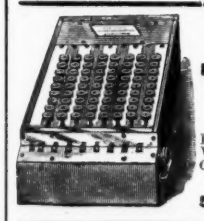

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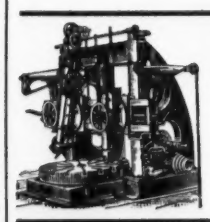

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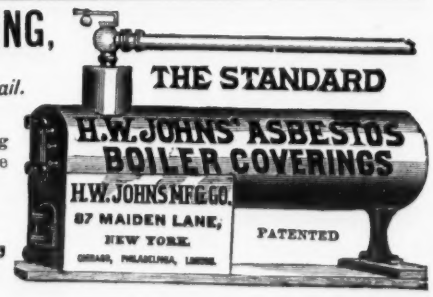

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78 do	9 ft. between centers				Sellers
38 do	17 ft. bed.	New			Fifield
30 do	14	do	do		do
27 do	16	do	do		
24 do	12	do	do		Fifield
24 do	12	do	do		Fitchburg
24 do	12	do	do		Flather
22 do	10	do	New Pattern		Fifield
22 do	12	do	do		do
22 do	12	do	New		Blaisdell
22 do	8	do	do		Flather
22 do	10	do	do		do
20 do	8	do	do		do
20 do	10	do	do		do
18 do	8	do	do		do
18 do	10	do	do		do
18 do	8	do	do		Blaisdell
18 do	16	do	do		do
16 do	6	do	do		Flather
16 do	6	do	do		Blaisdell
15 do	6	do	do		Flather
14 do	6	do	do		do
14 do	6	do	do		Blaisdell
12 do	6	do	do		do

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42 in. wide,	42 in. high,	12 ft. long,	2 heads	Gleason
36 do	36 do	8 do		Pease
30 do	30 do	8 do		do
30 do	30 do	8 do		Whitcomb
30 do	30 do	8 do		Flather
26 do	26 do	6 do		do
24 do	24 do	6 do		do
24 do	24 do	6 do		Whitcomb
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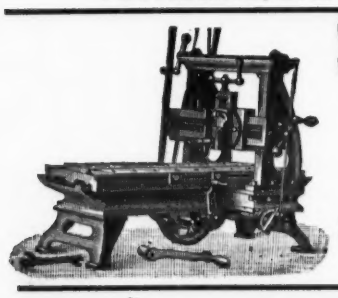
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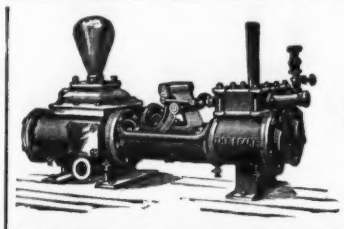
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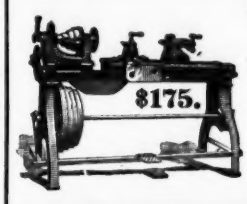

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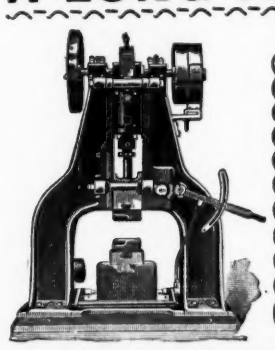
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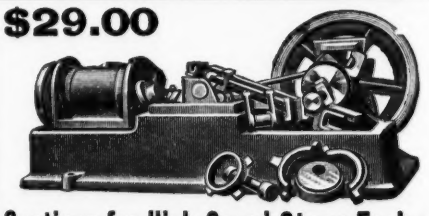
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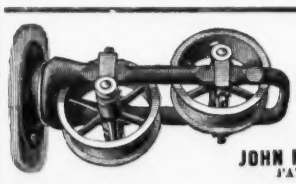
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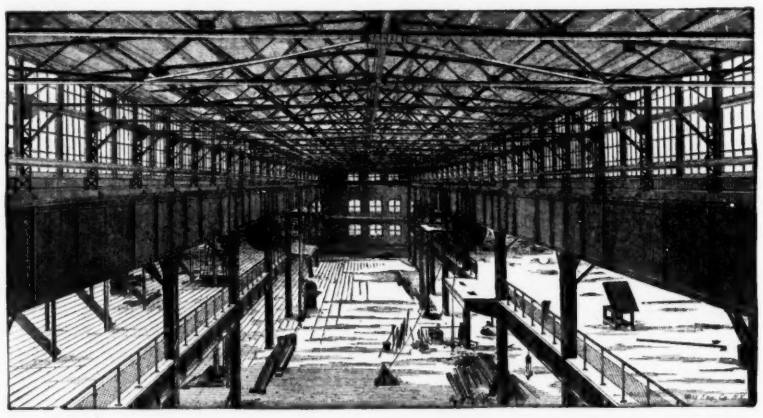

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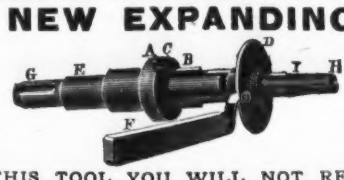

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5 " "	3	" 4 "	44

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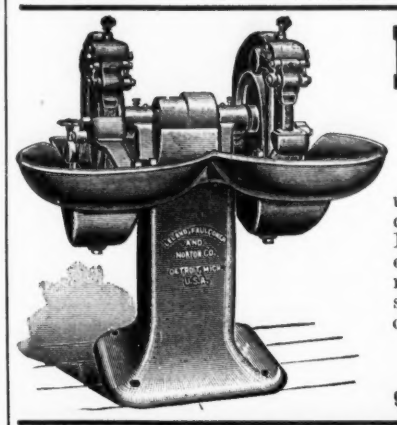

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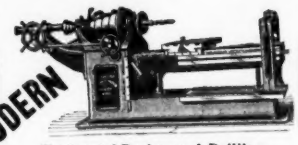

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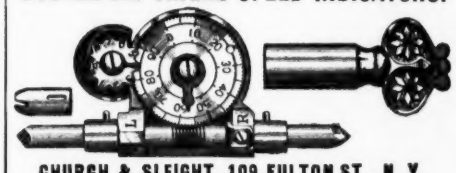

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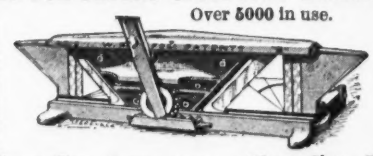

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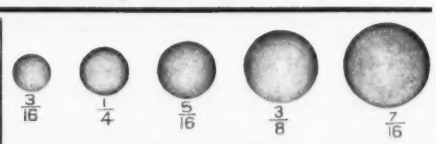

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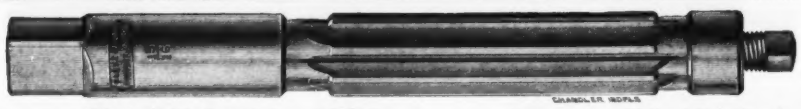

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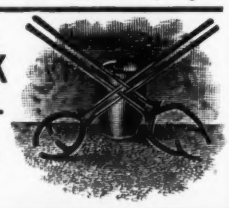

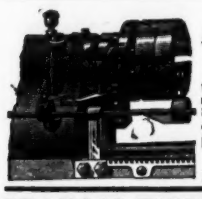

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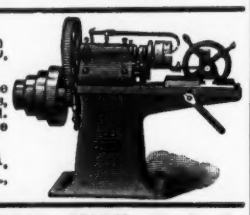

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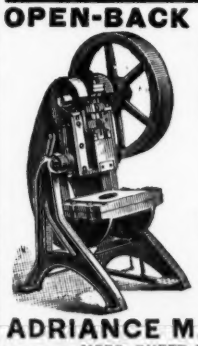

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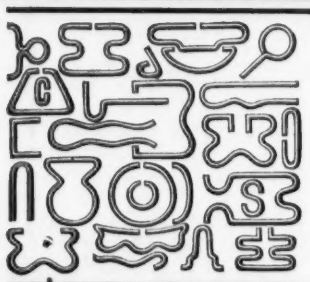

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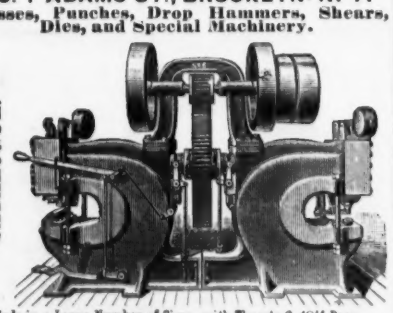

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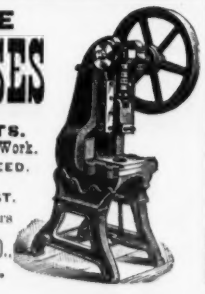

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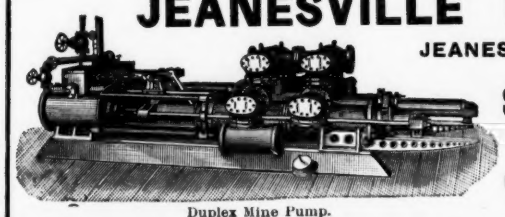

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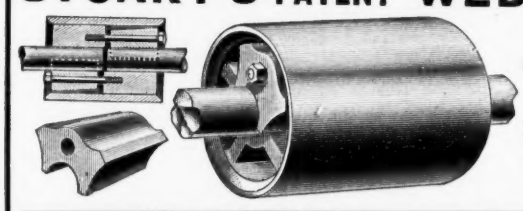

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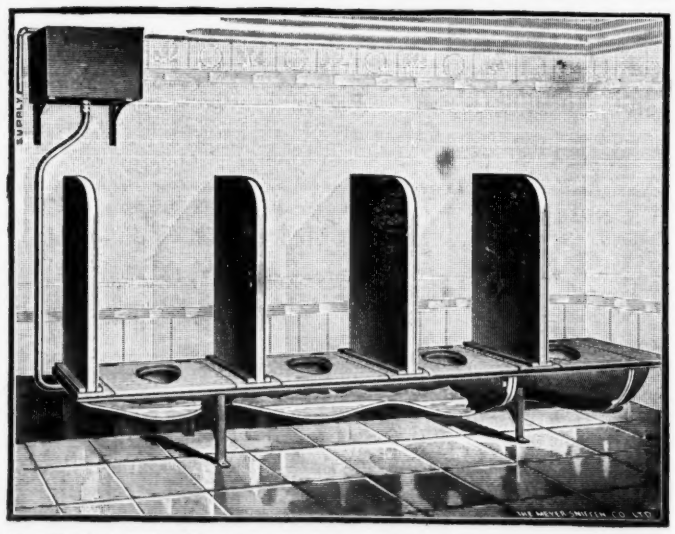

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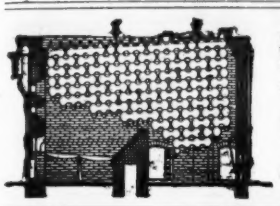

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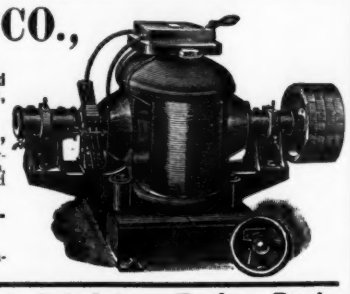

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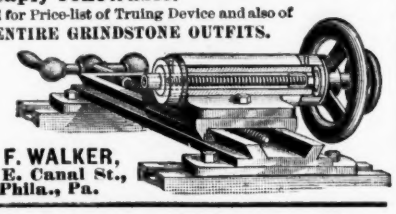

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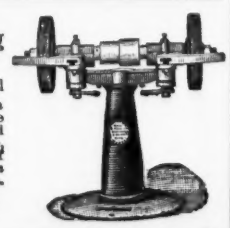

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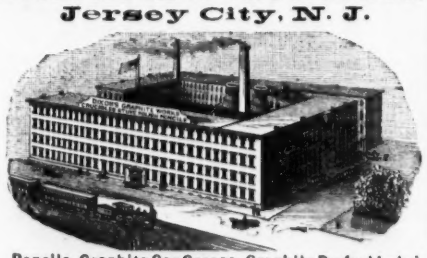

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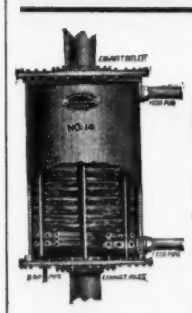

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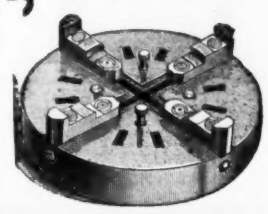

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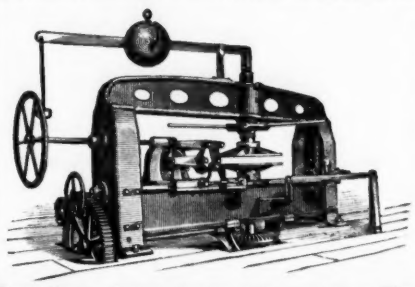

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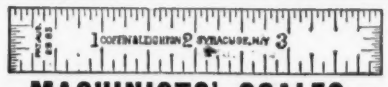

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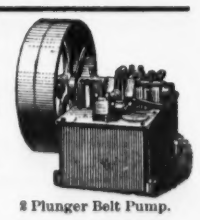

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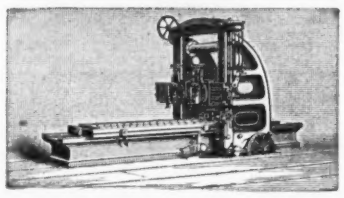

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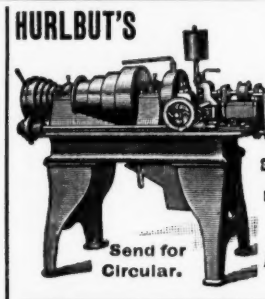

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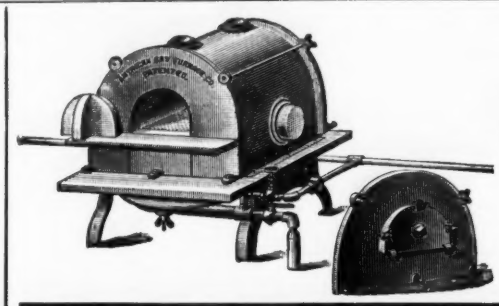

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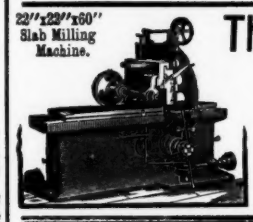

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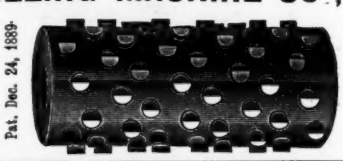

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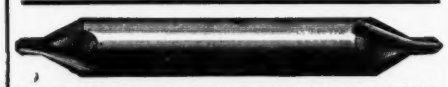

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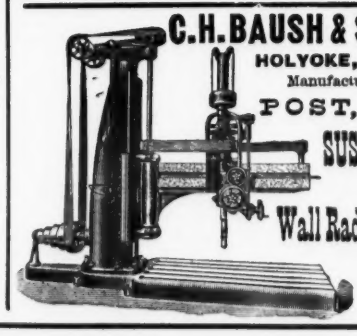

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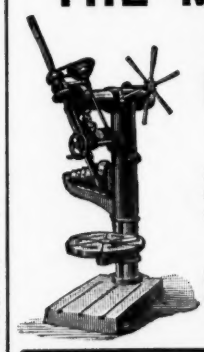

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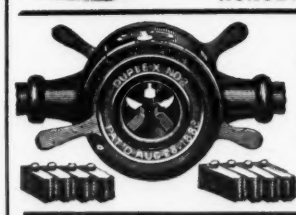

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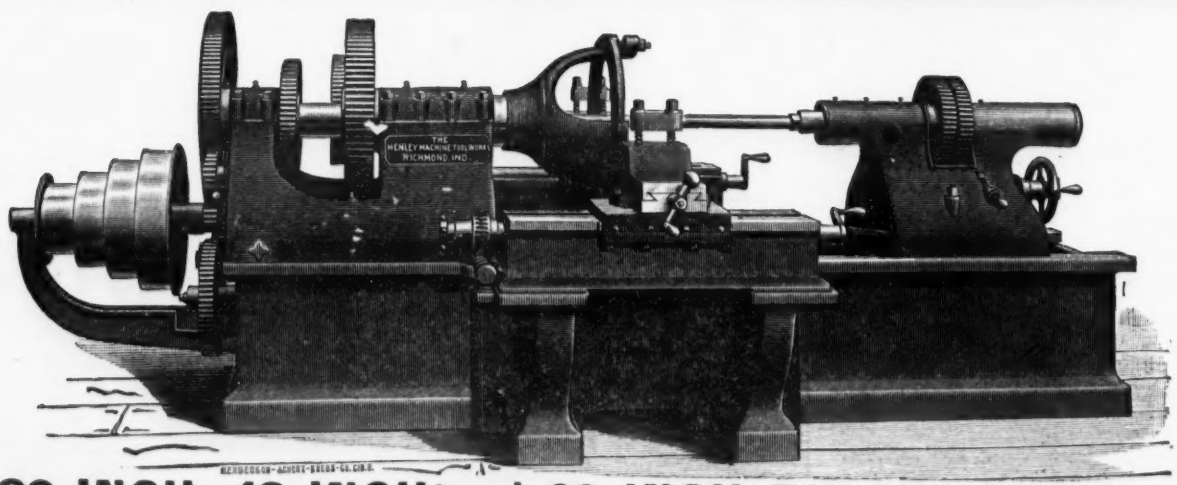

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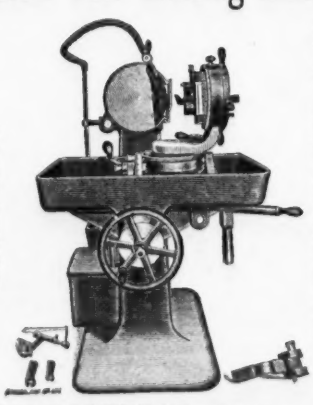

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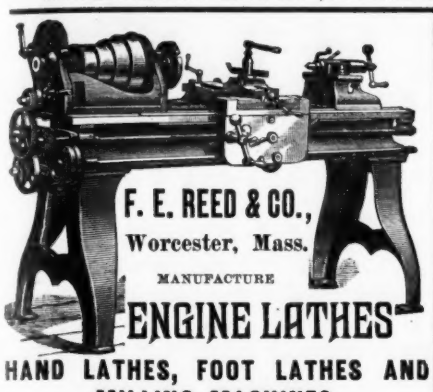

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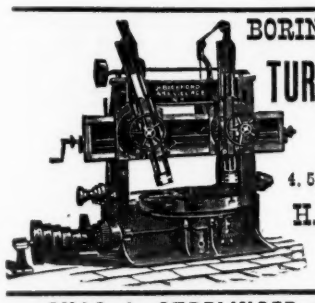

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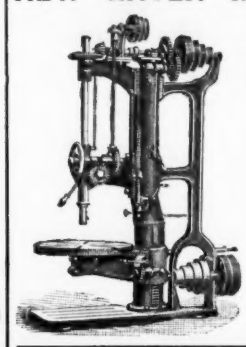

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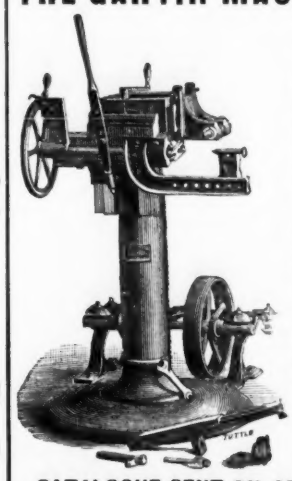

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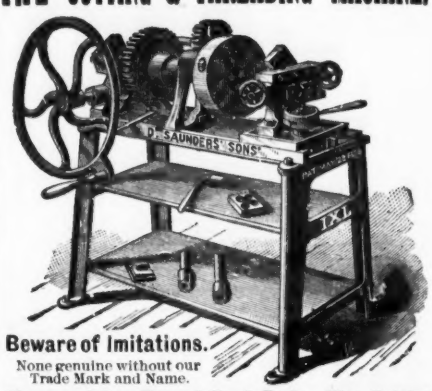

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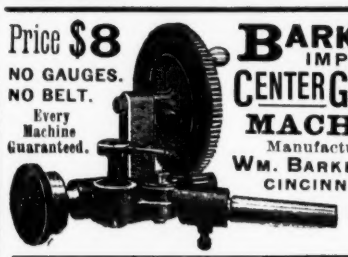

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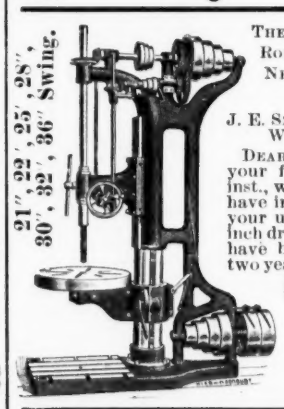

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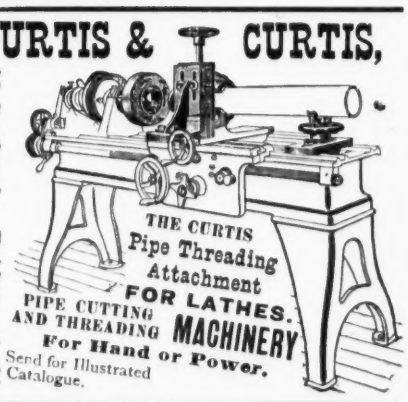

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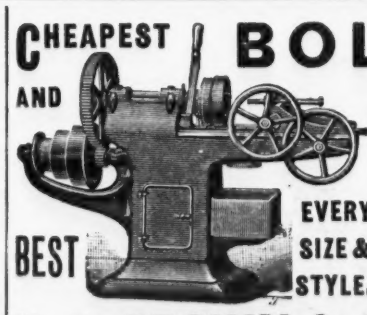

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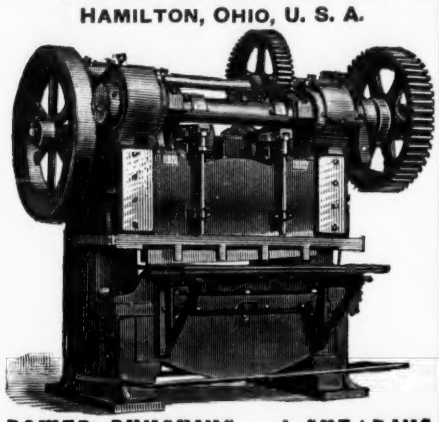

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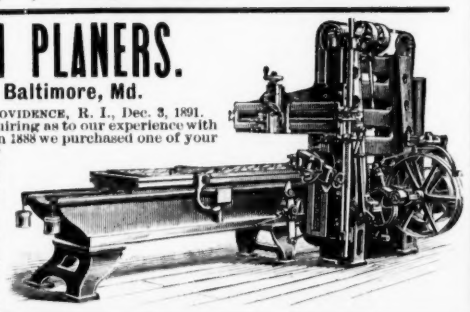

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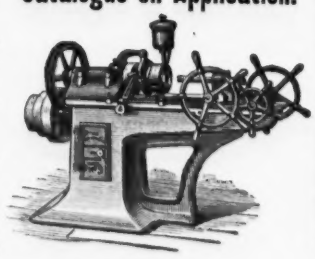

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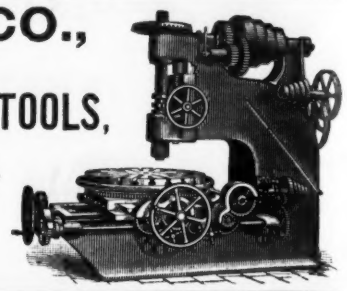

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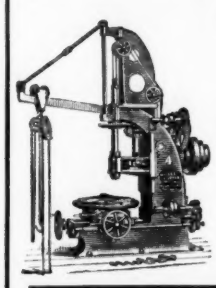

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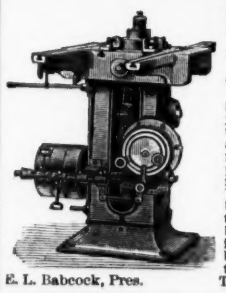

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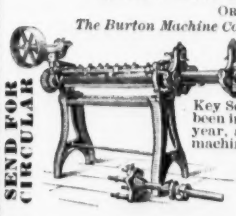

GENTLEMEN:—In reply to your favor of the 26th inst., would say that we have one of the Erie Key Seating Machines, which has been in constant use for the past year, and we find it an excellent machine, doing a large amount of work and in the best manner, and we are highly pleased with it.

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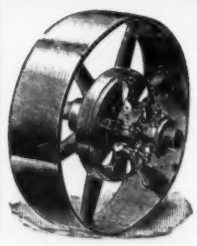

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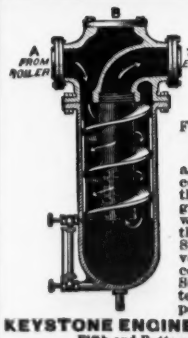

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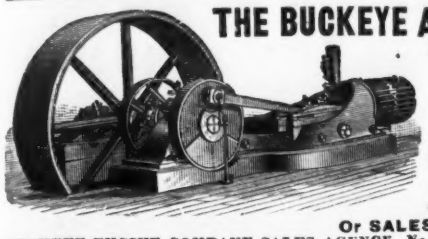

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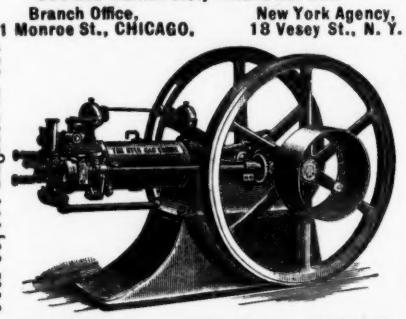

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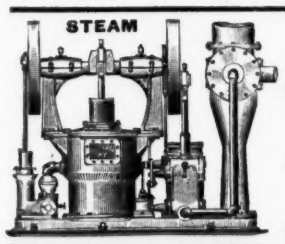

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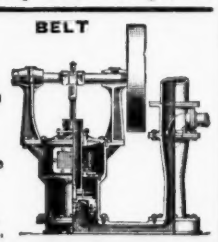

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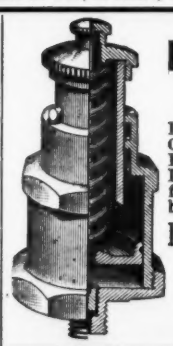

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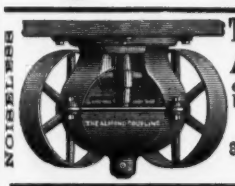

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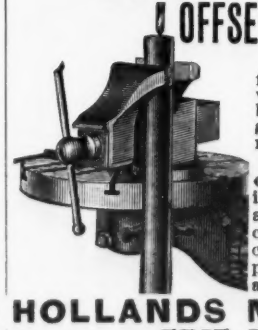

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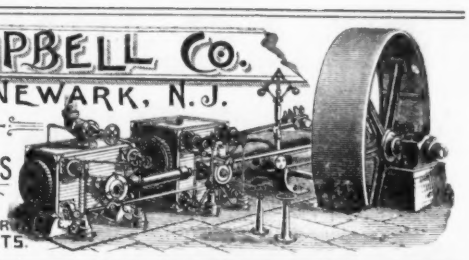

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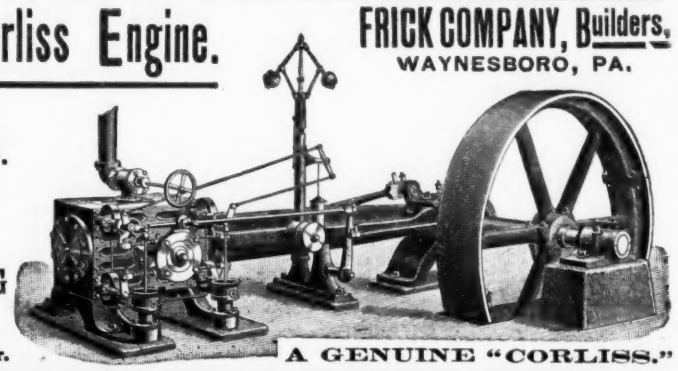

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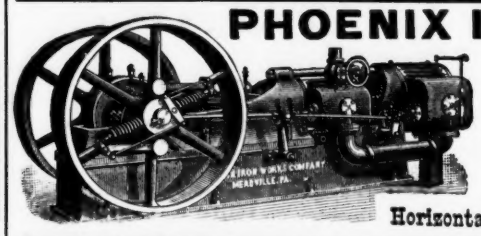

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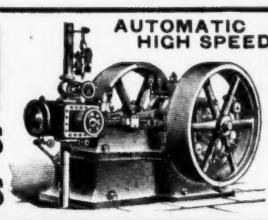

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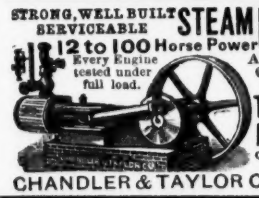

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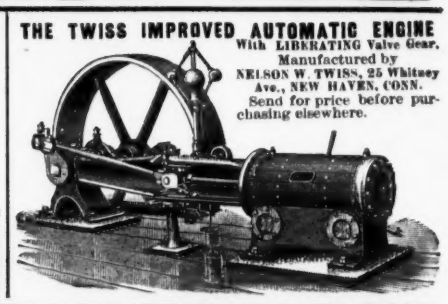

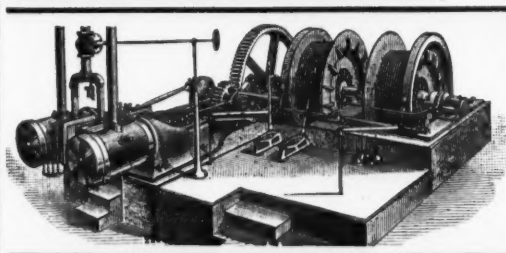

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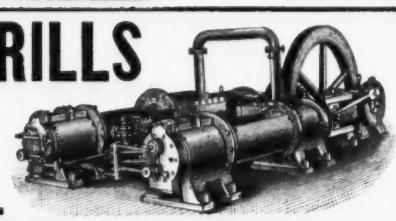

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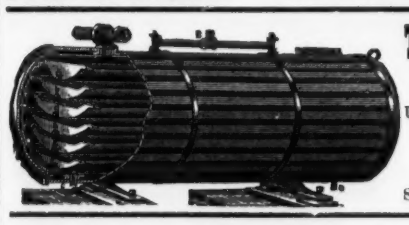

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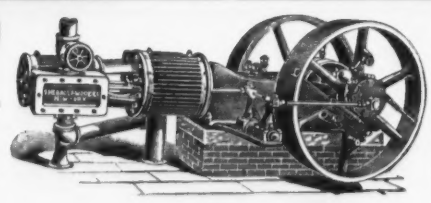

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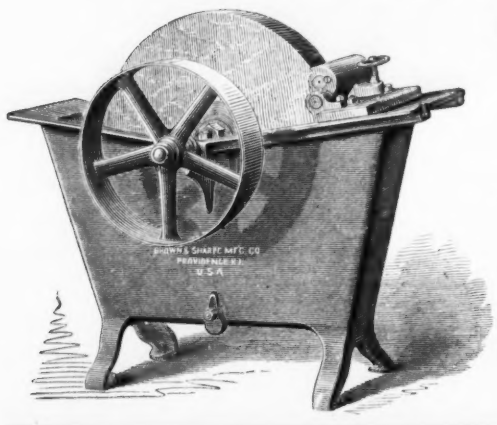

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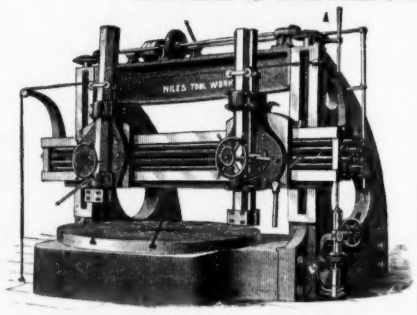

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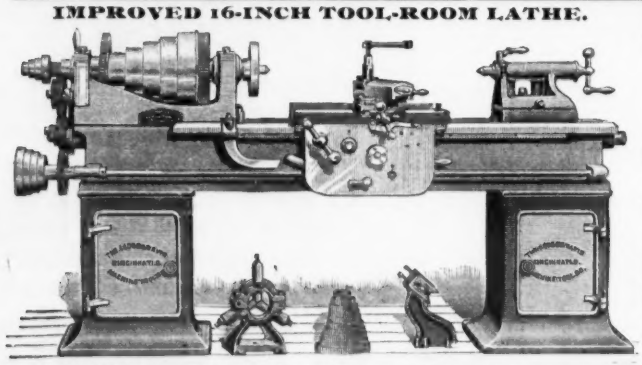

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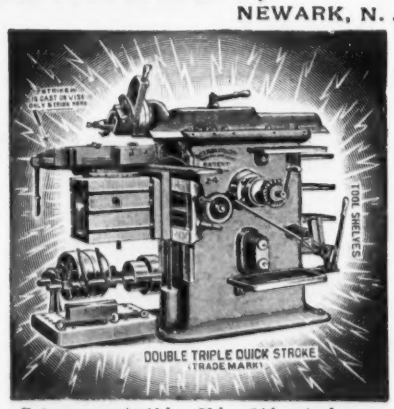

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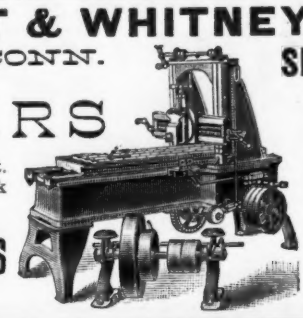

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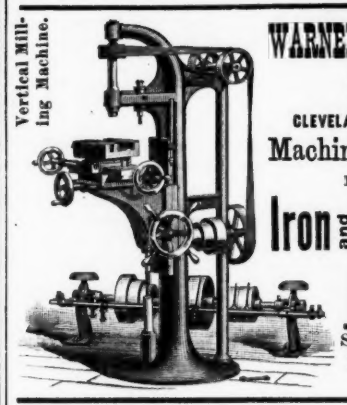

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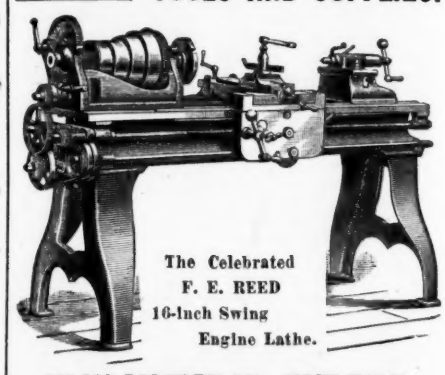

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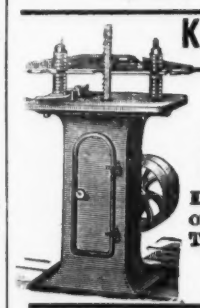

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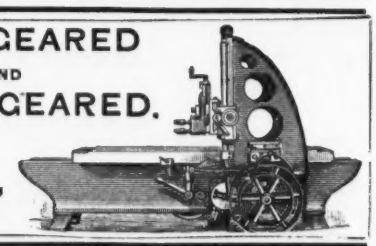

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